

NORTHERN INTEGRATED SUPPLY PROJECT

Applicant: Northern Colorado Water Conservancy District

Draft Environmental Impact Statement

April 2008



U.S. Army Corps of Engineers
Omaha District

DRAFT ENVIRONMENTAL IMPACT STATEMENT

NORTHERN INTEGRATED SUPPLY PROJECT

Applicant:
Northern Colorado Water Conservancy District

U.S. Army Corps of Engineers
Omaha District
12565 West Center Road
Omaha, Nebraska

April 2008

Martha S. Chieply, Chief
REGULATORY BRANCH
ARMY CORPS OF ENGINEERS, OMAHA DISTRICT

Date

This Draft Environmental Impact Statement was prepared by ERO Resources Corporation, an environmental consulting firm, with the guidance, participation, and independent evaluation of the U.S. Army Corps of Engineers (Corps). The Corps, in accordance with 40 CFR 1506.5(a) and (c), is in agreement with the findings of the analysis, and approves and takes responsibility for the scope and content of this document.

COVER SHEET
ENVIRONMENTAL IMPACT STATEMENT
NORTHERN INTEGRATED SUPPLY PROJECT

Lead Agency: Department of the Army
Corps of Engineers, Omaha District

Cooperating Agencies: Bureau of Reclamation
Colorado Department of Transportation
Larimer County
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

Jurisdictions in Colorado That Could Be Directly Affected: Larimer and Weld Counties

Abstract: The Northern Integrated Supply Project Draft Environmental Impact Statement (Draft EIS) evaluates the effects of constructing and operating the proposed Northern Integrated Supply Project (NISP) located in Larimer and Weld counties in northeastern Colorado. The U.S. Army Corps of Engineers (Corps), Bureau of Reclamation, and Colorado Department of Transportation will use this information to determine whether to approve permits and contracts necessary for construction and operation of NISP. As proposed by the Northern Colorado Water Conservancy District (District), NISP would consist of a proposed Glade Reservoir with a capacity of approximately 170,000 acre-feet (AF). Associated with Glade Reservoir would be a forebay, pump station, and diversion structure and canal upgrade to convey water diverted from the Cache la Poudre River to the proposed reservoir. A pipeline connecting the proposed Glade Reservoir to the existing Horsetooth Reservoir also would be constructed. Glade Reservoir would inundate a section of U.S. 287 and require the relocation of the highway. The proposed Project also would include a proposed Galeton Reservoir with a capacity of about 40,000 AF. Associated with Galeton Reservoir would be a forebay, pump station, and pipeline to deliver water diverted from the South Platte River to Galeton Reservoir. Water exchanges between the Galeton Reservoir and Glade Reservoir diversion locations are proposed.

The proposed Project is a collaborative effort among 12 water providers (Participants) facilitated and coordinated by the District. The proposed Project would provide approximately 40,000 AF of new reliable water supply, which would meet a portion of the Participants' estimated 2025 and 2050 water supply needs.

The Draft EIS evaluates four alternatives for NISP: 1) No Action; 2) Proposed Action Glade Reservoir at 170,000 AF and Galeton Reservoir at 40,000 AF; 3) Cactus Hill Reservoir at 180,000 AF and Galeton Reservoir at 40,000 AF; and 4) Glade Reservoir or Cactus Hill Reservoir and Galeton Reservoir at 20,000 AF and 12,000 AF of Agricultural Transfers. Two alternative realignments for U.S. 287 were evaluated as part of the Proposed Action. The District has submitted a Department of the Army permit application to the Corps for the Proposed Action.

Reviewers should provide the Corps with their comments during the review period for the Draft EIS. This will enable the Corps and cooperating agencies to analyze and respond to comments at one time and use the information acquired in the preparation of the Final Environmental Impact Statement. Comments on the Draft EIS should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3). The Corps will conduct a public hearing on the Draft EIS.

EIS Contact for Comments and Additional Information:

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Date Comments Must Be Received: July 30, 2008

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Acronyms and Abbreviations Used in this Document

ADT	Average daily traffic
AF	Acre-feet
APE	Area of potential effect
Applicant	Northern Colorado Water Conservancy District
bgs	Below ground surface
BLM	Bureau of Land Management
BMPs	Best management practices
CAA	Clean Air Act
CBGWS	Colorado Basic Ground Water Standards
CBP	Colorado butterfly plant
C-BT	Colorado-Big Thompson Project
CDOT	Colorado Department of Transportation
CDOW	Colorado Division of Wildlife
CDPHE	Colorado Department of Public Health and Environment
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cfs	Cubic feet per second
CNHP	Colorado Natural Heritage Program
CO	Carbon monoxide
Corps	U.S. Army Corps of Engineers
CPA	Cooperative planning area
CR	County Road
CRP	Conservation Reserve Program
CRRP	Colorado River Return Project (also known as Big Straw Project)
CSA	Community Service Area
CSU	Colorado State University
CU	Consumptive use
CWA	Clean Water Act
CWCB	Colorado Water Conservation Board
CWCWD	Central Weld County Water District
dB	Decibel scale
dBA	A-weighted levels
District	Northern Colorado Water Conservancy District
DOE	Determination of eligibility
DOLA	Department of Local Affairs
Draft EIS	Draft Environmental Impact Statement
EIS team	The U.S. Army Corps of Engineers and its consultants: ERO Resources Corporation, HDR Engineering, BBC Consulting, Chadwick Ecological Consultants Division of GEI, Western Cultural Resource Management
EIS	Environmental Impact Statement
ELC	Environmental Learning Center
ELCO	East Larimer County
EOM	End of month
EPA	U.S. Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera, and Trichoptera (mayflies, stoneflies, and caddisflies)

ERO	ERO Resources Corporation
ESA	Endangered Species Act
EX	Expressway
FCLWD	Fort Collins-Loveland Water District
GIS	Geographic information system
GMA	Growth Management Area
GMU	Game Management Unit
gpcd	Gallons per capita per day
gpm	Gallons per minute
GRM	Growth management area
HSWMPs	Halligan and Seaman Water Management Projects
Hansen Canal	Charles Hansen Supply Canal
HGM	Hydrogeomorphic Method
IFIM	Instream Flow Incremental Methodology
IGA	Intergovernmental Agreement
IY	Irrigation year
LCPOL	Larimer County Parks and Open Lands
LCR	Larimer County Road
LEDPA	Least environmentally damaging practicable alternative
LHWD	Lefthand Water District
LOS	Level of service
LTWD	Little Thompson Water District
M&I	Municipal and industrial
MBTA	Migratory Bird Treaty Act
MCQWD	Morgan County Quality Water District
mg	Million gallons
MP	Milepoint
MPWCD	Middle Park Water Conservancy District
NAAQS	National Ambient Air Quality Standards
NAWQA	National Water Quality Assessment Program
NCWA	Northern Colorado Water Association
NCWCD	Northern Colorado Water Conservancy District
NEPA	National Environmental Policy Act
NFR	North Front Range
NHPA	National Historic Preservation Act
NHS	National Highway System
NISP	Northern Integrated Supply Project
NOI	Notice of Intent
NPIC	North Poudre Irrigation Company
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NWCWD	North Weld County Water District
NWI	National Wetland Inventory
O&M	Operations and maintenance
OHWM	Ordinary high water mark
OP	Observation point
PA	Programmatic Agreement

Participants	The 12 communities and domestic water districts located throughout the Northern Colorado Water Conservancy District participating in NISP: Central Weld County Water District, Town of Eaton, Town of Erie, City of Evans, Fort Collins-Loveland Water District, City of Fort Lupton, City of Fort Morgan, City of Lafayette, Lefthand Water District, Morgan County Quality Water District, Town of Severance, and the Town of Windsor
PFYC	Probable Fossil Yield Classification system
PHABSIM	Physical Habitat Simulation
Phase II report	Phase II Alternative Evaluation Report
PM ₁₀	Particulate Matters less than 10 micron
Project	Northern Integrated Supply Project or NISP
Proposed Action	Participants' and District's preferred configuration of the proposed Project
PRPA	Platte River Power Authority
PVPL	Pleasant Valley pipeline
RCRA	Resource Conservation and Recovery Act
Reclamation	U.S. Bureau of Reclamation
RO	Reverse osmosis
ROD	Record of decision
ROW	Right-of-way
RTE	Residential tap equivalents
SB40	Senate Bill 40
SDWA	Safe Drinking Water Act
SEO	Colorado State Engineers Office
Service	U.S. Fish and Wildlife Service
SH	State Highway
SHPO	State Historic Preservation Office
SPWCP	South Platte Water Conservation Project
Subdistrict	Municipal Subdistrict of the Northern Colorado Water Conservancy District
SWA	State Wildlife Area
SWMP	Stormwater Management Plan
SWSP	Southern Water Supply Project
TCE	Trichloroethene
TCP	Traditional Cultural Property
TDS	Total dissolved solids
TE	Tap equivalent
TNM	Traffic Noise Model
TOC	Total organic carbon
U.S.	United States
UFR	Upper Front Range Regional Planning Commission
ULTO	Ute ladies' -tresses orchid
USGS	United States Geological Service
vpd	Vehicles per day
WAPA	Western Area Platte River Power Authority
WCR	Weld County Road
WGFP	Windy Gap Firing Project
WQCD	Water Quality Control Division
WSSC	Water Supply and Storage Company
WWTP	Wastewater treatment plant

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Executive Summary

Introduction

The proposed Northern Integrated Supply Project (NISP) is a regional water supply project designed to serve the current and future water needs of 12 towns and water districts (the Participants) in Larimer, Weld, Morgan, and Boulder counties. The Participants are a group of rapidly growing communities and domestic water districts located throughout the Northern Colorado Water Conservancy District (District). The Participants are Central Weld County Water District, Town of Eaton, Town of Erie, City of Evans, Fort Collins-Loveland Water District, City of Fort Lupton, City of Fort Morgan, City of Lafayette, Lefthand Water District, Morgan County Quality Water District, Town of Severance, and the Town of Windsor. The proposed Project would be constructed and owned by the District. While the District would retain ownership and operational responsibility of the Project, the Participants would own a perpetual contractual right to a defined portion of the Project facilities and a defined portion of the water diverted by the project.

The Proposed Action is construction of Glade Reservoir with a capacity of approximately 170,000 acre-feet (AF). Associated with Glade Reservoir would be a forebay, pump station, and diversion structure and canal upgrade to convey water diverted from the Cache la Poudre River to the proposed reservoir. A pipeline connecting the proposed Glade Reservoir to the existing Horsetooth Reservoir is proposed to be constructed if needed.

As proposed, Glade Reservoir would inundate a section of U.S. 287 and require the relocation of about 7 miles of the highway. Additionally, Glade Reservoir would inundate a section of the Munroe Canal (also known as the North Poudre Supply Canal) requiring a portion of the canal to be rerouted. The Proposed Action also would include a proposed Galeton Reservoir with a capacity of about 40,000 AF. Associated with Galeton Reservoir would be a new diversion structure on the South Platte River, forebay, pump station, and pipeline to deliver water diverted from the South Platte River to Galeton Reservoir. Water exchanges between the Galeton Reservoir and Glade Reservoir diversion locations are proposed.

Cooperating Agencies

This Draft Environmental Impact Statement (EIS) has been prepared in compliance with the U.S. Army Corps of Engineers (Corps) National Environmental Policy Act (NEPA) implementation procedures for its regulatory program (Appendix B of 33 CFR Part 325), and the 404(b)(1) guidelines (40 CFR Part 230), and applicable public interest review factors identified at 33 CFR Part 320.4.

Based on a review of the Project, the Corps determined that the Project is likely to significantly affect the quality of the human environment. Because the proposed Project will involve the discharge of dredge and fill material into wetlands or other waters of the U.S., the District will seek a permit under Section 404 of the Clean Water Act (CWA). The Corps is the lead federal agency for compliance with the NEPA and will use the EIS in rendering a final permit decision.

U.S. Bureau of Reclamation (Reclamation) is a cooperating agency because authorization to connect the pipeline and/or enter into a contract would be a federal action on the part of Reclamation. If Reclamation adopts the Final EIS as its NEPA compliance for federal action under its jurisdiction, Reclamation's decision on the Proposed Action and EIS will be documented in a separate record of decision (ROD).

The Colorado Department of Transportation (CDOT) will adopt the ROD upon completion of the EIS.

The U.S. Environmental Protection Agency (EPA), a federal cooperating agency, is responsible for cooperating on issues for which the agency has expertise, review of the Section 404 permit application that the District will submit to the Corps, and review of the EIS.

The NISP EIS will meet NEPA requirements for Reclamation. Reclamation will not prepare NEPA documents separate from the NISP EIS, but will prepare a ROD that addresses its action.

The U.S. Fish and Wildlife Service (Service) is a cooperating agency, and is responsible for consultation with the Corps and the District under the Endangered Species Act (ESA) and the Fish and Wildlife Coordination Act. The Service will consult regarding potential impacts to federally listed threatened or endangered species and their designated critical habitat based on the Biological Assessment prepared by the Corps and submitted to the Service.

Larimer County is a cooperating agency and must render a decision about the portions of the project located in Larimer County and the consistency of these portions with the County's Master Plan. Additionally, implementation of any of the action alternatives will require compliance with applicable state and local regulatory agency reviews, approvals, and permitting requirements.

Purpose and Need for the Project

The purpose of NISP is to provide the Participants with approximately 40,000 AF of new reliable municipal water supply annually through a regional project coordinated by the District. The Participants have requested new firm yield of water supply to meet a portion of their projected demand until 2050. The requests for new firm yield are based on the Participants' analyses of their projected needs, the potential future demands as modeled by the District and scrutinized by the Corps, plus a 10 percent safety factor to account for uncertainty about future demand. Some Participants face immediate water shortages; for others, shortages of firm water supply are expected over the next 10 to 20 years.

Public Agency and Participation

As required by NEPA, the Corps provided an early and open process to determine the scope of significant issues to be addressed in this Draft EIS. A Notice of Intent (NOI) to prepare an EIS initiated the 60-day scoping period and was published in the Federal Register on August 20, 2004. Notification consisted of paid advertisements announcing public scoping meetings in local newspapers, a scoping announcement, and publication of Project information on the District web site and Corps web site.

On September 21, 2004, an agency scoping meeting was held at the District's offices in Berthoud to review the project purpose and need, preliminary alternatives, and key environmental issues and agency concerns. The agency scoping meeting also included a field trip to several of the project elements for the Proposed Action.

Three public scoping meetings were held to present the project to the public and solicit public comments. The meetings were held on September 20, 2004 at the Eaton Country Club, September 21, 2004 at the Lincoln Center in Fort Collins, and September 22, 2004 at the American Legion in Laporte, Colorado. Public comments were accepted until November 24, 2004. Additionally, a public open house meeting was held on March 30, 2005 in Laporte to present alternative realignments under consideration for U.S. 287. A scoping report was prepared and posted on the Corps website on March 30, 2005 (<https://www.nwo.usace.army.mil/html/od-tl/eis-info.htm>).

Alternatives Analysis

In addition to satisfying NEPA requirements, projects subject to permitting by the Corps under the CWA also must comply with the Section 404(b)(1) guidelines (40 CFR Part 230) for discharge of dredge and fill material into waters of the U.S. The Section 404(b)(1) guidelines require that the Corps permits the least environmentally damaging practicable alternative. The alternatives analysis required for Section 404(b)(1) guidelines can be conducted either as a separate analysis for 404 permitting or incorporated into the NEPA process. The Corps integrated NEPA and 404(b)(1) guidelines into the alternatives analysis. Integration of both NEPA and 404(b)(1) guidelines ensures that the alternatives selected for evaluation in the EIS provide a reasonable range of alternatives and that the alternatives are practical.

In 2003, prior to the NISP EIS and as part of the development of a reliable future regional water supply for the Participants, the District studied potential Project alternatives. Subsequent to the District's study of potential alternatives, the Corps conducted an independent alternatives analysis that included three levels of screening (purpose and need, environmental, and practicability). Those concepts and elements that passed the multi-tiered screening were used to develop a reasonable range of alternatives to be evaluated in the EIS.

See Section 2.1 for a full explanation of the screening process used to develop alternatives for more detailed evaluation in this Draft EIS.

Alternatives

Four alternatives were selected for evaluation in this Draft EIS. The alternatives are:

- 1) No Action alternative—Participants would develop independent water supplies by purchasing water rights and pursuing independent storage and conveyance systems in the absence of NISP;
- 2) Proposed Action—Glade Reservoir (170,000 AF) and the South Platte Water Conservation Project (SPWCP), which includes a 40,000 AF Galeton Reservoir;
- 3) Cactus Hill Reservoir (180,000 AF) and the SPWCP, which includes a 40,000 AF Galeton Reservoir; and
- 4) Glade Reservoir (170,000 AF) or a Cactus Hill Reservoir (180,000 AF) subalternative and SPWCP, which includes a 20,000 AF Galeton Reservoir, with the transfer of agricultural water rights for 12,000 AF of firm yield.

The No Action alternative considers what the Participants would do to meet their water supply needs in the absence of NISP. In the absence of NISP, obtaining new water supplies in the region likely would become more challenging because the demand for a finite supply of water sources would increase. It is not possible to determine the specific mix of future water development approaches that would be pursued by the individual Participants because the process of acquiring water supplies would be driven by complex social, economic, environmental, and political factors. Therefore, the No Action alternative is conceptual, and is intended to represent the possible water supplies that each Participant could obtain.

The Corps identified three action alternatives—Alternatives 2, 3, and 4. Alternative 2, the Proposed Action, is a proposed Glade Reservoir with a capacity of approximately 170,000 AF. Associated with Glade Reservoir would be a forebay, pump station, improvements to the Poudre Valley Canal and diversion to convey water diverted from existing diversions on the Cache la Poudre River to the proposed reservoir, and temporary access roads to be used during construction. Glade Reservoir would inundate about 7 miles of U.S. 287, which would require the relocation of the inundated segment of the highway. Additionally, Glade Reservoir would inundate a section of

the Munroe Canal (North Poudre Supply Canal); therefore, a portion of the canal also would need to be rerouted. Water from Glade Reservoir would be conveyed to or exchanged with Horsetooth Reservoir for distribution to the Participants.

Alternative 3 is similar to the Proposed Action except that water diverted from the Poudre River would be stored in the proposed Cactus Hill Reservoir instead of the proposed Glade Reservoir. Cactus Hill Reservoir would have a capacity of approximately 180,000 AF. Construction of Cactus Hill Reservoir would include a forebay, improvements to the Poudre Valley Canal and intake headgate, and construction of temporary access roads. Construction would necessitate realignment of three Weld County Roads and two power lines.

Alternative 4 would utilize either Glade Reservoir or Cactus Hill Reservoir; therefore, Alternative 4 is similar to the Proposed Action or Alternative 3 except that about 12,000 AF of the Participants' requested yield would come from the purchase and transfer of agricultural water rights to municipal and industrial (M&I) use. This alternative likely would reduce the amount of water that would need to be diverted from the South Platte River through the SPWCP when compared to the Proposed Action and Alternative 3. The size of the proposed Glade Reservoir under Alternative 4 would be 170,000 AF (the same size as under the Proposed Action), Cactus Hill Reservoir would be 180,000 AF (the same as Alternative 3), and Galeton Reservoir would be constructed to store 20,000 AF of water to reflect the contribution of the transferred water (a reduction of 20,000 AF relative to the Proposed Action or Alternative 3).

Existing Conditions

The NISP Participants' water supplies are composed of: direct flow from the Cache la Poudre, St. Vrain, and Big Thompson rivers; transbasin supplies from the Colorado River Basin; reservoir storage; and mutual ditch, irrigation, and reservoir company shares within the Poudre, St. Vrain, and Big Thompson River basins. The common water supply among all the Participants is the Colorado-Big Thompson (C-BT) project. Annual yields from the NISP Participant supplies vary depending on available water each year and system losses.

The Participants serve residential, agri-business, agricultural, M&I, and recreational users. From 1990 to 2000, Colorado added 1 million residents to its population. A large part of the growth between 1990 and 2002 occurred in the region where the NISP Participants are located. This growth is projected to continue, although it may vary widely from year to year over the next 50 years.

The annual combined gallons per capita per day (gpcd) for potable deliveries for the Participants from 1998 to 2003 indicated usage rates that fluctuate largely with weather and water use restrictions. Although each Participant's water use pattern is unique because the mix of customer types varies, for the 1998 to 2003 period, the average potable water use of the NISP Participants was 164 gpcd. If nonpotable deliveries are included, total water use by NISP Participants is about 189 gpcd.

Future Water Needs

The Participants' projected future water demands were calculated based on existing firm yield, which is the yield that would be available to a Participant during a drought. Between 2005 and 2010, the combined total future water demand for the NISP Participants will exceed their existing, combined annual firm yield (50,005 AF). By the year 2025, the projected demand is 90,700 AF. The NISP Participants have requested 40,000 AF in combined new firm yield from NISP. From a combined standpoint, the NISP Participants are projected to need the full yield

and storage from NISP no later than 2020. The NISP Participants will need additional supplies from that point forward (Table ES-1). Participant water supply and demand is fully described in Section 1.8.

NISP will supply a portion of the Participants' future water supply needs, but will not fully meet the Participants' estimated future water supply needs. Because all of the Participants face water shortages that would only partly be met by the new firm yield they have requested from NISP, it is likely that all of the Participants would pursue additional water sources no matter if NISP is implemented.

Table ES-1. Projected Shortages in Firm Yield (AF).

Participant	Firm Yield ¹	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	Year of Projected Shortage
CWCWD	8,465	2,000	-840	-3,200	-5,300	-7,100	-8,700	-10,400	-11,700	-12,900	-14,120	2010
Eaton	1,616	180	-30	-230	-430	-630	-830	-1,000	-1,200	-1,400	-1,600	2010
Erie	2,145	-360	-2,300	-3,800	-5,300	-6,800	-6,800	-6,800	-6,800	-6,800	-6,800	2005
Evans ²	6,932	2,300	1,000	-100	-1,500	-2,800	-4,200	-5,900	-6,400	-6,400	-6,400	2015
FCLWD	8,156	-1,100	-3,300	-5,400	-7,600	-7,800	-7,800	-7,800	-7,800	-7,800	-7,800	2005
Fort Lupton	3,538	-560	-660	-860	-1,160	-1,500	-1,700	-2,100	-2,400	-2,800	-3,300	2005
Fort Morgan	4,481	-900	-1,700	-2,100	-2,400	-2,800	-3,200	-3,600	-4,100	-4,600	-5,100	2005
Lafayette	4,534	30	-1,000	-2,000	-3,000	-4,000	-4,100	-4,100	-4,100	-4,100	-4,100	2010
LHWD	4,712	510	-190	-990	-1,900	-2,900	-4,100	-5,100	-5,100	-5,100	-5,100	2010
MCQWD	2,512	310	310	10	-190	-490	-690	-900	-1,100	-1,300	-1,500	2020
Severance	422	120	-80	-280	-580	-1,100	-1,600	-2,300	-2,900	-2,900	-2,900	2010
Windsor	2,492	-210	-1,000	-1,800	-2,700	-3,500	-4,300	-5,200	-6,000	-6,900	-7,200	2005
Total	50,005	2,320	-9,790	-20,750	-32,060	-40,420	-48,020	-55,200	-59,600	-63,000	-65,920	2010

¹Does not include a 10 percent safety factor for demand projections.

²It is possible that Evans projected shortage in 2035 and beyond could range from 4,000 AF to 6,200 AF if Evans is able to change the water right for the Evans Ditch, either by changing the diversion point, exchanging water with an upstream user, constructing a treatment plant, or other means.

Environmental Consequences

In providing 40,000 AF in combined firm yield to the Participants, all of the NISP alternatives would have significant environmental effects. Many of the environmental effects are common to the alternatives; however, there are differences among the alternatives in how they would affect environmental resources. Alternative 1 (No Action) would rely primarily on the conversion of agricultural water rights to M&I use to provide the firm yield to the Participants. The most significant effect associated with Alternative 1 would be the removal of irrigation from up to 69,200 acres of agricultural lands and the conversion of the irrigated agricultural lands to dry land uses. The action alternatives (Alternatives 2, 3, and 4) would rely on the District's Grey Mountain and SPWCP water rights and, therefore, have similar effects on streamflows of the Poudre and South Platte rivers. All of the action alternatives would affect flows in the Poudre River in two ways: first, water would be diverted from the Poudre River when the District's Grey Mountain water right is in priority. The District does not currently exercise the Grey Mountain water right; therefore, these diversions would cause new depletions to the Poudre River. The diversions would occur primarily from the Poudre Valley Canal during periods of high flows; thus, the greatest changes in flows would typically occur in May, June, and July of wet and average years. Diversions when the

Grey Mountain water right is in priority would affect flows in about 55 miles of the Poudre River from the Poudre Valley Canal to the confluence with the South Platte River.

Second, all of the action alternatives have the SPWCP as a component that involves an exchange of water diverted from the South Platte River for water diverted from the Poudre River. The exchange involves diverting water from the Poudre River at the Poudre Valley Canal, which is currently diverted from the Poudre River about 23 miles downstream for irrigation. The exchange diversions would not be new to the Poudre River, but would occur about 23 miles higher in the Poudre River. Therefore, the exchange would reduce existing flows in about 23 miles of the Poudre River, from the Poudre Valley Canal located downstream of the mouth of Poudre Canyon, through Laporte and Fort Collins, to about 12 miles downstream of Fort Collins. The exchange would not affect existing flows on the Poudre River downstream of the New Cache Canal diversion, which is the most downstream anticipated exchange location.

The greatest effect of NISP on Poudre River flows would be the combined effect of the exchange and the exercise of the Grey Mountain water right. This combined reduction in flow would occur on an approximate 23-mile reach of the Poudre River from the Poudre Valley Canal, downstream of the mouth of Poudre Canyon to the diversion for the New Cache Canal about 2 miles south of Timnath. The District's Proposed Action (Alternative 2) would reduce monthly average streamflow through Fort Collins as represented by the Lincoln Avenue gage in May, June, July, and August of all years, ranging from a 71 percent reduction in May of average years to a 26 percent reduction in streamflow in August of dry years.

The reduction in streamflow to the Poudre River at the Lincoln Avenue stream gage for Alternatives 3 and 4 is similar to the District's Proposed Action with the exception that Alternative 3 (Cactus Hill Reservoir and SPWCP) and Subalternative 4.2, which also includes Cactus Hill Reservoir, have slightly greater streamflow reductions in wet and average years. This difference is due to the larger size of the proposed Cactus Hill Reservoir (180,000 AF) compared to the proposed Glade Reservoir (170,000 AF). Cactus Hill Reservoir is proposed to be larger to compensate for increased evaporation on the plains relative to the higher elevation foothills location of Glade Reservoir.

The following summarizes the effects that distinguish each of the alternatives.

Alternative 1—No Action

The No Action alternative is not expected to substantially affect streamflows in the region. It was assumed that the current points of diversion would not change due to the inability to predict where the changes would occur. Measures would be required in the adjudication process of transferring the agricultural water rights to M&I use to ensure no injury to other water users on the various streams and rivers. The Participants would be required to continue historical diversion and return flow patterns.

The purchase of C-BT units and the relocation of their place of use is a common practice within the boundaries of the District. Because C-BT water is transmountain water, this process is permitted without mitigating any changes in flow experienced by downstream water users. Depending on how the units are relocated, there could be minor localized increases or reductions in the flows of stream reaches, but on balance, changes in flows would be negligible.

Municipal well pumping from the South Platte River alluvium by Fort Morgan and Fort Lupton would likely occur out-of-priority, because new wells would have very junior water rights. As a result, these entities would need to acquire senior agricultural water to augment South Platte River flows. This process mitigates water rights

impacts due to the increased well pumping. Acquisition and transfer of agricultural water for augmentation purposes would require maintenance of the existing return flow regime to avoid injury to other water users. The conversion of gravel pits to water storage reservoirs for Alternative 1 would require water to augment evaporation losses from the gravel pits, and would therefore mitigate effects to streamflows. The No Action alternative would allow the water rights junior to the District's Grey Mountain water right to seek a permit to divert the flows and it is unknown what the impact on the Poudre River flows would be. It is likely that the Poudre River flows would be reduced under a different water right if the No Action alternative is implemented.

The No Action alternative would involve the removal of irrigation from up to 69,200 acres of irrigated agricultural lands, about 11 percent of the total irrigated acreage in the region, and would substantially accelerate and contribute to the regional trend of the transfer of agricultural water to M&I uses. The current production value associated with the 69,200 acres is estimated at \$27.1 million or about 4.5 percent of total agricultural output in the region.

The removal of irrigation from up to 69,200 acres of agricultural lands would result in a loss of about 1,384 acres of wetlands, which is substantially greater than any of the other alternatives. At a projected total capital cost of about \$830,500,000, the No Action alternative would cost substantially more than the other alternatives and would have the greatest increase in inflation-adjusted rate increases for the Participants' water bills of 38 percent (2010) and 17 percent (2020) relative to the other alternatives.

Alternative 2—Proposed Action—Glade Reservoir and SPWCP

As previously discussed, Alternative 2 and the other action alternatives would reduce streamflows in the Poudre and South Platte rivers. The effects of reduced streamflows distinguish Alternative 2 and the other action alternatives (Alternatives 3 and 4) from the No Action alternative; however, these effects for the most part, are not useful in determining the differences among the action alternatives.

There are some differences in the way the action alternatives would affect streamflows. Those alternatives involving the proposed Cactus Hill Reservoir would cause slightly greater reductions of about 2 to 3 percent in streamflows due to the larger storage volume of Cactus Hill Reservoir compared to Glade Reservoir. Cactus Hill Reservoir would be 10,000 AF larger to compensate for increased evaporation on the plains compared to the foothills location of Glade Reservoir. Additionally, Glade Reservoir would deliver water near the delivery point for C-BT water from Horsetooth Reservoir to the Poudre River, Glade Reservoir (Alternatives 2 and 4) could exchange C-BT water into Horsetooth Reservoir and deliver exchanged C-BT water from Glade Reservoir to the Poudre River about 7 miles above Fort Collins. Because of Glade Reservoir's location, it could also divert water from the Poudre River using the Munroe Canal diversion, which is about 5 miles higher on the Poudre River than the Poudre Valley Canal diversion. Use of the Munroe Canal diversion could facilitate another exchange of C-BT water with the North Poudre Irrigation Company (NPIC). Glade Reservoir could deliver Glade Reservoir water to the Munroe Canal near the Glade dam site in exchange for C-BT water. The C-BT water that would have been diverted by the NPIC at the Munroe Canal would stay in the Poudre River for about 5 miles until diverted by Glade Reservoir and the Poudre Valley Canal. Therefore, the alternatives involving Glade Reservoir could increase flows in the 5-mile reach of the Poudre River between the Munroe Canal diversion and the Poudre Valley Canal. Increased flows in the range of 38 to 43 cfs would occur in late summer and could extend the boating season into August on the much used Filter Plant segment of the Poudre River as long as there is sufficient C-BT water carried by the Munroe Canal to make the exchange.

Alternative 2 would involve the inundation of about 7 miles of U.S. 287. The relocation of U.S. 287 would have environmental effects in addition to the effects of the construction and operation of Glade Reservoir and the SPWCP. The following effects include Glade Reservoir, the SPWCP and associated facilities, and the realignment of U.S. 287.

Alternative 2 would cause the direct loss of about 44 acres of wetlands. This loss of wetlands is the lowest wetland loss of all of the alternatives. Alternative 2 would cause the greatest loss of native plant communities (2,705 to 2,807 acres), about 20 percent more than the other action alternatives, but would have substantially fewer impacts to all vegetation (3,942 acres) than Alternative 3 (6,927 acres).

Glade Reservoir (Alternative 2 and Subalternative 4.1) would cause the loss of about 50 acres of the federally threatened Preble's meadow jumping mouse habitat and disturb another 26 acres of habitat. The alternatives that do not include Glade Reservoir (No Action alternative, Alternative 3, and Subalternative 4.2) have no known direct impact on any federally listed species or their habitat.

Glade Reservoir (Alternative 2 and Subalternative 4.1) is the only alternative facility that may be managed for public recreation. Recreation at the reservoir was estimated to provide an annual public recreation value of about \$17,115,400. Public recreation at the reservoir would seasonally increase traffic in the vicinity of Glade Reservoir. In addition to U.S. 287, the construction of Glade Reservoir would also inundate access to the State Trust Land west of the proposed reservoir. Access to Bonner Spring Ranch Road, and Big Ridge Way may need realignment, but would not be inundated by Glade Reservoir.

Glade Reservoir (Alternative 2 and Subalternative 4.1) is the only alternative facility that has any known geological issues. A fault in the vicinity of the dam may cause construction and seepage issues that would need to be addressed in the final design. The western realignment alternative for U.S. 287 involves a rock cut through the Morrison Formation, a known fossiliferous formation. Other alternatives do not involve substantial disturbances to known fossiliferous formations.

TCE contaminated ground water located in the vicinity of the forebay will require mitigation efforts associated with forebay construction activities.

The projected total capital cost for Alternative 2 is about \$426 million (excludes the Carter pipeline option) and is projected to be the least expensive alternative. Alternative 2 is projected to result in an inflation-adjusted rate increase for the Participants' water bills of 10 percent (2010) and -6 percent (2020).

Alternative 3—Cactus Hill Reservoir and SPWCP

Similar to the other action alternatives (Alternatives 2 and 4), Alternative 3 would reduce streamflows in the Poudre and South Platte rivers. As discussed under Alternative 2, Alternative 3 would result in slightly greater reductions in streamflows due to the increased size of Cactus Hill Reservoir to offset increased evaporation of the proposed Cactus Hill Reservoir relative to proposed Glade Reservoir. Cactus Hill Reservoir distinguishes Alternative 3 and Subalternative 4.2 from Alternative 2 and Subalternative 4.1, which include the proposed Glade Reservoir.

Cactus Hill Reservoir has a larger volume than Glade Reservoir and is substantially shallower with a greater surface area than Glade Reservoir. The greater surface area of Cactus Hill Reservoir would result in a substantially greater loss of vegetation (6,237 acres) than Alternative 2 (3,942 acres). Alternative 3 would cause the loss of 79 acres of wetlands.

Alternative 3 would involve the relocation of Weld County Roads 19 and 20, and Platte River Power transmission lines that would be inundated by Cactus Hill Reservoir. Cactus Hill Reservoir would inundate 11 private residences and an additional nine residences are within 1,000 feet of the proposed Cactus Hill Reservoir.

The projected total capital cost for Alternative 3 is about \$452,192,200 (excluding the Carter pipeline option), which is more than Alternative 2 but less than the other alternatives. Alternative 3 is projected to result in inflation-adjusted rate increases for the Participants' water bills of 12 percent (2010) and -5 percent (2020).

Alternative 4—Glade Reservoir or Cactus Hill Reservoir and SPWCP and Agricultural Transfers

Similar to the other action alternatives (Alternatives 2 and 3), Alternative 4 would reduce streamflows in the Poudre and South Platte rivers. Subalternative 4.1 includes Glade Reservoir and Subalternative 4.2 substitutes Cactus Hill Reservoir for Glade Reservoir. Both subalternatives involve a reduced Galeton Reservoir (20,000 AF) and obtaining 12,000 AF of the 40,000 AF of firm yield from agricultural transfers that would remove irrigation from an estimated 17,137 acres of agricultural lands. The reduced size of Galeton Reservoir and substitution of 12,000 AF of yield from agricultural transfers lessens the reductions in streamflows in the South Platte River associated with the SPWCP relative to Alternatives 2 and 3, but would not affect flow reductions in the Poudre River associated with Alternative 2 or 3. For example, in average years in June when flows are estimated to be reduced the most in the South Platte River (14.9 percent by Alternative 2 or 15.4 percent by Alternative 3), Alternative 4 would have smaller flow reductions in the South Platte River (1.9 percent for Subalternative 4.1 and 1.8 percent for Subalternative 4.2). Approximately 397 acres of wetlands would be lost under Subalternative 4.1, and approximately 385 acres would be lost under Subalternative 4.2. Most of these losses (353 acres) would be due to transfer of agricultural lands. The combination of agricultural transfers with either Glade Reservoir (Subalternative 4.1) or Cactus Hill Reservoir (Subalternative 4.2) would result in environmental effects between the No Action alternative and Alternative 2 (matched with Subalternative 4.1) and Alternative 3 (matched with Subalternative 4.2).

Projected total capital costs for Subalternative 4.1 (\$570 million) and Subalternative 4.2 (\$596 million) are greater than Alternatives 2 and 3, but are less than the No Action alternative. Subalternative 4.1 is projected to result in inflation-adjusted rate increase for the Participants' water bills of 19 percent (2010) and no change (2020), and under Subalternative 4.2, 21 percent (2010) and 1 percent (2020).

Cumulative Effects

Cumulative effects are the impacts on the environment that result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such action (40 CFR 1508.7). Past actions related to water development have resulted in cumulative effects, which continue to influence the present environmental conditions, which in turn will be affected by the NISP alternatives and reasonably foreseeable actions. The following past actions are viewed as continuing regional trends most likely to interact with the alternatives and cause cumulative effects:

- Increase for need of M&I water
- Increase in water supply project development to meet increased need for M&I water
- Increase of the transfer of agricultural water to M&I use
- Increase in water conservation by water providers and users
- Decrease in lands devoted to agricultural production

- Increase in developed lands
- Increase in population
- Increase in infrastructure to support population growth

These regional trends have resulted in changes in flows in the Poudre and South Platte rivers including reduced peak flow and increased base flows. These regional trends have also resulted in changes in land use including the reduction of agricultural and undeveloped lands due to residential and commercial development and construction of associated infrastructures, and the transfer of irrigation water to M&I use.

Several reasonably foreseeable actions in the region were identified. These reasonably foreseeable actions were categorized as either water-based or land-based activities. The following were identified as reasonably foreseeable water-based actions:

- Halligan and Seaman Water Management Projects
- Windy Gap Firing Project
- Dry Creek Reservoir Project
- Moffat Collection System Project
- Chatfield Reservoir Reallocation
- City of Denver Reuse Project
- City of Aurora Prairie Waters Project
- Cache la Poudre River Flood Reduction and Ecosystem Project
- Augmentation of lower South Platte River wells
- City of Fort Collins water craft course
- Greeley and CDOW new fishing access
- Termination of municipal/domestic leaseback of C-BT water to agriculture
- Modified diversion patterns above the mouth of Poudre Canyon
- Greeley Bellvue Pipeline Project
- Climate change

The following were identified as reasonably foreseeable land-based actions:

- Reservoir construction and expansion
- Population growth in the northern Front Range
- Land development
- North I-25 transportation improvements
- Commercial and residential development along the Poudre River in Fort Collins
- Poudre River regional trail connections

The incremental effects of the alternatives combined with regional trends, past and present actions, and reasonably foreseeable actions are summarized in Table ES-2.

Alternative 1

Cumulative effects resulting from the incremental effects of the No Action alternative (Alternative 1) added to other past, present, and reasonably foreseeable water-based actions are unlikely to occur because the transfer of agricultural water to M&I use is unlikely to result in overall reductions to streamflows in the Poudre and South

Platte rivers except in reaches affected by a change in the point of diversion. However, the No Action alternative would incrementally add to the cumulative effect and regional trend of the reduction in agricultural land and productivity due to the removal of irrigation from up to 69,200 acres of irrigated agricultural lands.

Alternative 2

Cumulative effects resulting from the incremental effects of the Proposed Action (Alternative 2) added to other past, present, and reasonably foreseeable water-based activities are likely to occur. The trend of decreasing flows in the Poudre River would be incrementally increased by Alternative 2 combined with the Halligan and Seaman Water Management Projects (HSWMPs). Alternative 2, when combined with past actions, would further reduce flows in the Poudre River from near the mouth of the Poudre Canyon to the confluence with the South Platte River when NISP was diverting, primarily during wet and average water years. When combined with the HSWMPs, Alternative 2 would further reduce flows in the Poudre River from near the mouth of the Poudre Canyon to above Fort Collins. Alternative 2 would also add to the trend of altered flows in the South Platte River.

Alternative 3

The cumulative effects associated with Alternative 3 would be similar to the cumulative effects for Alternative 2 except the reductions in flow on the Poudre and South Platte rivers would be slightly greater for Alternative 3 due to the larger size of Cactus Hill Reservoir (180,000 AF) relative to Glade Reservoir (170,000 AF).

Alternative 4

Alternative 4 would have water-based and land-based cumulative effects. The water-based cumulative effects on the Poudre River would be the same for Subalternative 4.1 (Glade Reservoir) and Subalternative 4.2 (Cactus Hill Reservoir). The transfer of water from 17,137 acres of irrigated agricultural lands would lessen flow reduction in the South Platte River compared to Alternatives 2 and 3 due to a smaller SPWCP. However, the dry up of 17,137 acres of irrigated agricultural land would add to the regional trend of reduction in agricultural land productivity.

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Table ES-2. NISP Cumulative Effects on Regional Trends.

Regional Trends	Past and Present Actions	Reasonably Foreseeable Actions	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Water-Based Effects						
Reduced flows in Poudre River	On average, about 430,000 AF of the annual flow of the Poudre River is diverted for ag. and M&I use.	Halligan and Seaman Projects – anticipated to increase trend of reduced flows.	Neutral – would not increase or decrease trend.	Would reduce high flows in wet and average years, and when combined with the HSWMPs would contribute to the trend of reduced flows in the Poudre River, from the canyon mouth through Fort Collins.		
		Windy Gap Firming Project – would not reduce Poudre River flows.	0 ¹	0	0	0
		Dry Creek Reservoir – would not reduce Poudre River flows.	0	0	0	0
		Moffat Collection System Project – would not affect Poudre River flows.	0	0	0	0
		Chatfield Reservoir reallocation – would not affect Poudre River flows.	0	0	0	0
		City of Denver Reuse Project – would not affect Poudre River flows.	0	0	0	0
		City of Aurora Prairie Waters Project – would not affect Poudre River flows.	0	0	0	0
		Poudre River Flood Reduction and Ecosystem Restoration Project – would not affect normal flows in the Poudre River flows,	0	Would reduce high flows, and when combined with the flood reduction project, would likely further reduce flood flows to the degree that NISP diverts during flood flows.		

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Regional Trends	Past and Present Actions	Reasonably Foreseeable Actions	Alternative 1	Alternative 2	Alternative 3	Alternative 4
		but would reduce flood stage in a 17-mile reach near Greeley.				
		Augmentation of lower South Platte River wells – would not affect Poudre River flows.	0	0	0	0
		City of Fort Collins water craft course – would not affect Poudre River flows, but diversions that would reduce streamflows in the Poudre River below 150 cfs during the boating season would shorten the season for use of the proposed course.	0	Diversions from the Poudre River would shorten the seasonal use of the proposed course in May and July of average years. The course would not be functional in dry years with the proposed minimum design flows. NISP, and potentially Halligan and Seaman, would further reduce flows in the vicinity of the proposed paddle park.		
		Greeley and CDOW new fishing access.	0	0	0	0
		Termination of municipal/domestic leaseback of C-BT to ag.	Would further decrease the need for irrigation water including C-BT, which would decrease delivery of irrigation water via the Poudre River.	When combined with the action alternatives, the reduction or termination of C-BT leaseback/rental programs to ag. could in the future result in reduced releases of C-BT from the Hansen Canal outlet to the Poudre River and reduced exchange capacity on the Poudre River.		
		Modified diversion patterns above the mouth of the Poudre Canyon.	0	0	0	0

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Regional Trends	Past and Present Actions	Reasonably Foreseeable Actions	Alternative 1	Alternative 2	Alternative 3	Alternative 4
		Greeley Bellvue Pipeline Project.	0	When combined with the action alternatives, the additional capacity provided by the pipeline could facilitate the transfer of ag. water to M&I and diversion of the transferred water higher in the Poudre River Basin, resulting in reduced flows on the lower Poudre River.		
		Climate change.	0	Climate change may affect precipitation, Poudre River streamflows, and the amount of water available for diversion by NISP, which could alter how the action alternatives operate and, in combination with the action alternatives, could further alter flows in the Poudre River.		
Changes in flows in the South Platte River that have resulted in a trend of reduced peak flows and increased base flows.	Historically, the flows in the South Platte River have been altered by extensive storage, diversion for agriculture, and M&I uses and imports to the South Platte River Basin.	Halligan and Seaman Projects – may decrease flows in the South Platte River due to reductions in flows in the Poudre River.	0	Would reduce flows in the South Platte River due to the SPWCP and reductions to flow in the Poudre River. Would reduce high flows in June of wet and average years by about 12% and 15%, respectively. Winter time flows would be reduced by 5% to 11%.		Lessens flow reduction in South Platte River compared to Alternatives 2 and 3 due to a smaller SPWCP.
		Windy Gap Firming Project – may increase base flows of the South Platte River depending on the degree to which the imported Windy Gap water is reused.	0	Depending on the degree to which Windy Gap water is reused, the Windy Gap Firming Project may lessen the reductions of South Platte River flows associated with NISP.		
		Dry Creek Reservoir – stores C-BT water for drought protection and return flows from this imported water could increase the base flows of the South Platte River.	0	Depending on the degree to which return flows from participants in Dry Creek Reservoir reach the South Platte River; Dry Creek Reservoir may lessen the reductions in South Platte River flows associated with NISP.		

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Regional Trends	Past and Present Actions	Reasonably Foreseeable Actions	Alternative 1	Alternative 2	Alternative 3	Alternative 4
		Moffat Collection System Project – return flows from the imported water associated with this project could increase the base flows of the South Platte River, depending on the degree to which the imported water is reused.	0	Modeled flow reductions for NISP in the South Platte River included future estimated reuse of water imported by the Moffat Collection System Project. Denver’s reuse of the imported water would not provide water that could offset flow reductions in the South Platte River associated with NISP.		
		Chatfield Reservoir Reallocation Project – could seasonally increase flows in the South Platte River from Chatfield Reservoir to Kersey depending on the alternative selected and how the reallocation is managed.	0	Depending on how the Chatfield Reservoir Reallocation Project is managed, it may lessen the flow reductions to the South Platte associated with NISP.		
		City of Denver Reuse Project – would increase Denver’s reuse of imported water. The increased reuse of imported water would reduce the contribution of imported water to the South Platte River.	0	Modeled flow reductions for NISP in the South Platte River included future estimated reuse of water imported by Denver. Denver’s increased reuse of the imported water would not provide water that could offset flow reductions in the South Platte River associated with NISP.		
		City of Aurora Prairie Waters Project – would increase the reuse of imported water. The increased reuse of imported water would reduce the contribution	0	Modeled flow reductions for NISP in the South Platte River included future estimated reuse of water imported by Aurora. Aurora’s increased reuse of the imported water would not provide water that could offset flow reductions in the South Platte River associated with NISP.		

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Regional Trends	Past and Present Actions	Reasonably Foreseeable Actions	Alternative 1	Alternative 2	Alternative 3	Alternative 4
		of imported water to the South Platte River.				
		Poudre River Flood Reduction and Ecosystem Restoration Project – would not directly affect South Platte River flows, but may help attenuate fixed flows in the Poudre River that could help to reduce flood flows on the South Platte River.	0	It is unlikely that the Poudre River flood reduction project combined with NISP would affect flows in the South Platte River.		
		Augmentation of lower South Platte River wells – would increase base flows and decrease high flows and possibly winter flows in the South Platte River.	0	Augmentation plans on the South Platte River are likely to be diverting water from the South Platte River at about the same time of year as the SPWCP. Therefore, NISP, combined with the well augmentation, is likely to decrease flows in the South Platte River during the fall and winter.		
		City of Fort Collins Water Craft Course – would not affect South Platte River flows.	0	0	0	0
		Greeley and CDOW New Fishing Access – would not affect South Platte River flows.	0	0	0	0
		Termination of municipal/domestic leaseback of C-BT to ag.	Would further decrease the need for irrigation water including C-BT, which could decrease delivery of irrigation water via the Poudre River.	When combined with the action alternatives, the reduction or termination of C-BT leaseback/rental programs to ag. could in the future result in reduced releases of C-BT, which could affect flows on the South Platte River.		

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Regional Trends	Past and Present Actions	Reasonably Foreseeable Actions	Alternative 1	Alternative 2	Alternative 3	Alternative 4
		Modified diversion patterns above the mouth of the Poudre Canyon.	0	0	0	0
		Greeley Bellvue Pipeline Project.	0	0	0	0
		Climate change.	0	Climate change may affect precipitation, South Platte River streamflows, and the amount of water available for diversion by NISP, which could alter operation of the SPWCP and, in combination with the action alternatives, could further alter flows in the South Platte River.		
Land-Based Effects						
Reductions in agricultural and undeveloped lands due to residential and commercial development and associated infrastructure, and the transfer of irrigation water to M&I use.	The cumulative effects study area has had rapid development over the past 20 years that has significantly increased the area of developed lands and reduced the area of agricultural lands.	Reservoir construction and expansion – would inundate agricultural lands.	The removal of irrigation from up to 69,200 acres of irrigated ag. land would significantly increase the trend in reduced ag. productivity.	Would incrementally add to the loss of agricultural lands due to construction of facilities.		The removal of irrigation from 17,137 acres of irrigated ag. land would significantly increase the trend in reduced ag. productivity.
		Population growth in the northern Front Range – population growth would not directly affect ag. lands; however, land use changes associated with population growth are anticipated to result in a reduction of ag. lands.	All of the alternatives are responding to current and projected population growth and the alternatives would not have an incremental effect on population growth.			
		Land development – the area of developed urban land in the cumulative effects study area is expected to increase by about 160% over 25 to	The removal of irrigation from up to 69,200 acres of irrigated ag. land would significantly increase the trend	Would incrementally add to the loss of agricultural lands due to construction of facilities.		The removal of irrigation from 17,137 acres of irrigated ag. lands would significantly increase the trend

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Regional Trends	Past and Present Actions	Reasonably Foreseeable Actions	Alternative 1	Alternative 2	Alternative 3	Alternative 4
		50 years. This substantial increase in developed lands would greatly reduce ag. lands.	in reduced ag. productivity.			in reduced ag. productivity.
		North I-25 Transportation Improvements – may have minor reductions in ag. lands.	The removal of irrigation from up to 69,200 acres of irrigated ag. land would significantly increase the trend in reduced ag. productivity.	Would incrementally add to the loss of agricultural lands due to construction of facilities.		The removal of irrigation from 17,137 acres of irrigated ag. lands would significantly increase the trend in reduced ag. productivity.
		Commercial area residential development in Fort Collins along the Poudre River – would not add to the trend of reduced ag. lands.	0	0	0	0
		Timnath Poudre trail connection – not anticipated to add to the trend of reduced ag. lands.	0	0	0	0

¹0 indicates that the alternative is not anticipated to incrementally add to the regional trend when combined with past, present, and future actions.

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Chapter 1

Background

The Town of Berthoud has withdrawn from NISP. All references to Berthoud should be ignored. Berthoud's contract in NISP has been acquired by Frederick, which is served by the Central Weld County Water District. This change will be reflected in the Final EIS.

1.1 INTRODUCTION

This Draft Environmental Impact Statement (EIS), prepared by the U.S. Army Corps of Engineers (Corps), documents the analysis of potential environmental consequences associated with the proposed Northern Integrated Supply Project (NISP or Project), a regional water supply project designed to serve the current and future water needs of 12 towns and water districts in Larimer, Weld, Morgan, and Boulder counties.

1.1.1 Federal Actions and NEPA Process

U.S. Army Corps of Engineers

Because the proposed Project will involve the discharge of dredge and fill material into wetlands or other waters of the U.S., a permit is required from the Corps under Section 404 of the Clean Water Act (CWA). The Northern Colorado Water Conservancy District (District), acting by and through the Northern Integrated Supply Project Water Activity Enterprise, has notified the Corps that it will seek a Section 404 permit for the Project. Based on a review of the Project, the Corps determined that the Project is likely to significantly affect the quality of the human environment and therefore, an EIS should be prepared. The Corps is the lead federal agency for compliance with the National Environmental Policy Act (NEPA) and will use the EIS in rendering a final permit decision.

Issuance of a permit would be a Corps federal action. This Draft EIS has been prepared in compliance with the Corps' NEPA implementation procedures for its regulatory program (Appendix B of 33 CFR Part 325), and the 404(b)(1) guidelines (40 CFR Part 230), and applicable public interest review factors identified at 33 CFR Part 320.4.

The Bureau of Reclamation (Reclamation) has a discretionary federal action related to the Corps' federal action as described below.

Bureau of Reclamation

All of the action alternatives propose to use some East Slope Colorado-Big Thompson (C-BT) project facilities to distribute NISP water to the Participants (see Section 1.1.2 for description of the Participants). Most C-BT facilities are owned by the United States and operated by Reclamation in coordination with the District. Use of C-BT facilities would require approvals from Reclamation and would be related federal actions to the NISP action alternatives. Reclamation is a cooperating agency responsible for addressing Reclamation's related actions and ensuring that the NISP EIS addresses Reclamation's NEPA requirements.

The C-BT Project was developed by Reclamation between 1938 and 1957. The project was designed to provide water for agricultural, municipal, and industrial (M&I) uses for the benefit of both the east and west slopes. On the east slope, the C-BT Project provides supplemental water to 33 cities and towns and is used to help irrigate almost 700,000 acres of northeastern Colorado farmland. On average, about 210,000 acre-feet (AF) of water is delivered to northeast Colorado.

The complex C-BT collection, distribution, and power system comprises 12 reservoirs, 35 miles of tunnels, 95 miles of canals, and 700 miles of transmission lines. West of the Continental Divide,

Willow Creek and Shadow Mountain reservoirs, Grand Lake and Lake Granby collect and store the water of the upper Colorado River. Water is pumped into Shadow Mountain Reservoir from Lake Granby where it flows by gravity into Grand Lake. From there, the 13.1-mile Adams Tunnel transports the water under the Continental Divide to the East Slope.

Once the water reaches the East Slope, it is used to generate electricity as it falls almost 0.5 mile through five power plants on its way to Colorado's Front Range. Carter Lake, Horsetooth Reservoir, and Boulder Reservoir store the water. C-BT water is released as needed to supplement native water supplies in the South Platte River Basin.

The District's Proposed Action proposes to deliver water to the Participants by exchange using Horsetooth Reservoir and Carter Lake, which are C-BT facilities. As proposed, NISP water stored in Glade Reservoir would be used to meet some requests for C-BT water from Horsetooth Reservoir and Carter Lake, and these deliveries of NISP water from Glade Reservoir would be exchanged for a like amount of water to be delivered to the Participants from Horsetooth Reservoir or Carter Lake. The District's Proposed Action also proposes to construct a pipeline between Glade Reservoir and Horsetooth Reservoir. The District anticipates that the proposed Glade to Horsetooth pipeline would not need to be constructed as long as there is sufficient C-BT exchange potential in the Poudre Basin to implement the exchanges. The anticipated future conversion of C-BT units from agricultural uses to M&I uses will limit the C-BT exchange potential in the Poudre Basin in the future and may require the future construction of the Glade to Horsetooth pipeline. Deliveries to the Participants are described for each action alternative in Chapter 2.

Reclamation's discretionary federal actions involve entering into a contract with the District for storage and/or exchange of NISP water in C-BT facilities and issuance of a special use permit that would authorize the connection of the pipeline from Glade Reservoir to Horsetooth Reservoir.

Prior to entering into a contract that would allow use of C-BT excess capacity, Reclamation must determine that the excess capacity contract is consistent with the provisions of Senate Document 80 (SD 80) and Reclamation's authority under Section 14 of the Reclamation Project Act of 1939 (43 U.S.C. § 389). This determination will be made available at a later time and is not part of this EIS. However, following is an explanation of the factors that will be considered in making this determination.

A. Senate Document 80

The "MANNER OF OPERATION OF PROJECT FACILITIES AND AUXILIARY FEATURES" ("Manner of Operation") is set forth on pages 2 through 5 of SD 80 and is incorporated into the Blue River Decrees, which decreed water rights for the C-BT Project. The Manner of Operation states that the C-BT Project, "... must be operated in such a manner as to most nearly effect the following primary purposes:"

1. To preserve the vested and future rights in irrigation.
2. To preserve the fishing and recreational facilities and the scenic attractions of Grand Lake, the Colorado River, and the Rocky Mountain National Park.
3. To preserve the present surface elevations of the water in Grand Lake and to prevent a variation in these elevations greater than their normal fluctuation.
4. To so conserve and make use of these waters for irrigation, power, industrial development,

and other purposes, as to create the greatest benefits.

5. To maintain conditions of river flow for the benefit of domestic and sanitary uses of this water.

To accomplish these purposes, Manner of Operation goes on to state that the project, "... should be operated by an unprejudiced agency in a fair and efficient manner, equitable to all parties having interests therein..." and in conformity with lettered 12 stipulations.

Reclamation's determination will consider the effects of the proposed project on Reclamation's ability to continue meeting the five primary purposes of the C-BT Project and whether or not the C-BT Project can continue to be operated in accordance with lettered stipulations (a) through (l) in the Manner of Operation.

B. Section 14 of the Reclamation Project Act of 1939

Section 14 of the Reclamation Project Act of 1939 ("Section 14") provides in part as follows:

"The Secretary is further authorized, for the purpose of orderly and economical construction or operation and maintenance of any project, to enter into such contracts for exchange or replacement of water, water rights, or electric energy, or for the adjustment of water rights, as in his judgment are necessary and in the interests of the United States and the project."

Section 14 requires a finding that the exchanges contemplated under the proposed project are (1) for the purpose of orderly and economical operation and maintenance of the C-BT Project and (2) necessary and in the interests of the United States and the C-BT Project. Reclamation's determination will document whether or not the proposed project and anticipated contract or contract amendment(s) meet these two requirements of Section 14.

This determination will be developed, and made public, prior to execution of a contract or contract amendment that would allow implementation of any of the action alternatives considered in this EIS. Following completion of the EIS, Reclamation will prepare a Record of Decision (ROD) that addresses Reclamation's discretionary actions and the agency's decisions regarding these actions.

Colorado Department of Transportation

The District's Proposed Action includes realignment of a portion of U.S. 287 at the proposed Glade Reservoir site. CDOT is responsible for addressing this related action and ensuring that the NISP EIS addresses CDOT's NEPA requirements. As a cooperating agency, CDOT will be responsible for selection of alternative alignments, analysis of impacts associated with the proposed alternative alignments, and public involvement related to the proposed realignment of U.S. 287.

The evaluation of the proposed realignment of U.S. 287 is addressed as a subalternative under the District's Proposed Action throughout the EIS. A decision on permitting a water supply project for the Participants will be made by the Corps. Decisions regarding the realignment of U.S. 287 will be made jointly by CDOT and the Corps. Following completion of the EIS, CDOT will adopt the Corps' ROD.

1.1.2 Proposed Project

The proposed Project is a collaborative effort among 12 water providers (Participants) facilitated and coordinated by the District. The proposed Project would provide approximately 40,000 AF of new reliable water supply, which would meet a portion of the Participants' estimated 2025 and 2050 water supply needs. The Participants are a group of rapidly growing communities and domestic water

districts located throughout the District. The proposed Project would not be constructed with federal funds, or owned or operated by the federal government. The proposed Project would be constructed and owned by the District. While the District would retain ownership and operational responsibility of the Project, the Participants would own a perpetual contractual right to a defined portion of the Project facilities and a defined portion of the water diverted by the project.

1.1.3 District's Proposed Action

Prior to the EIS process, the District conducted an alternatives evaluation for NISP (MWH 2004). As part of the alternatives evaluation, the District and Participants identified a preferred configuration of the proposed Project (the District's Proposed Action). The District's Proposed Action is the proposed Glade Reservoir with a capacity of approximately 170,000 AF. Associated with Glade Reservoir would be a forebay, pump station, and canal upgrade to convey water diverted from the Cache la Poudre River to the proposed reservoir. A pipeline connecting the proposed Glade Reservoir to the existing Horsetooth Reservoir also would be constructed. As proposed, Glade Reservoir would inundate a section of U.S. 287 and require the relocation of the highway. Additionally, Glade Reservoir would inundate a section of the Munroe Canal (North Poudre Supply Canal) requiring a portion of the canal to be rerouted. The proposed Project also would include a proposed Galeton Reservoir with a capacity of about 40,000 AF. Associated with Galeton Reservoir would be a forebay, pump station, and pipeline to deliver water diverted from the South Platte River to Galeton Reservoir. Water exchanges between the Galeton Reservoir and Glade Reservoir diversion locations are proposed. The Proposed Action is more fully

described in Chapter 2, which also includes Project location maps.

1.1.4 Contents of Draft EIS

This Draft EIS contains seven chapters. Chapter 1 describes the project purpose and need as defined by the Corps, Reclamation, and the District, and provides a Project overview and background. Chapter 2 describes the District's Proposed Action and other alternatives considered as part of this Draft EIS, including the No Action alternative. Chapter 3 includes a description of the affected environment for water resources, water rights, geology, soils, vegetation, noxious weeds, wetlands and other waters, riparian resources, wildlife, fish and other aquatic life, species of concern, recreation, cultural resources, aesthetics and visual resources, traffic and transportation, land use, socioeconomic resources, hazardous sites, noise, air quality, and energy use. Chapter 4 provides results of investigations into the potential environmental consequences of the Project, including the District's Proposed Action, and the other alternatives considered as part of this Draft EIS. Chapter 4 also contains an analysis of the cumulative effects of the Project. Chapter 5 discusses mitigation. Chapter 6 summarizes public and agency consultation and coordination. Chapter 7 is the reference list for the Draft EIS.

1.2 NORTHERN INTEGRATED SUPPLY PROJECT PARTICIPANTS

NISP Participants include municipalities and rural domestic water districts. These entities and their new firm yield goals from NISP are listed in Table 1-1. Terms such as firm yield are defined in the Glossary.

The service areas for these Participants are shown in (Figure 1-1).

Table 1-1. Participants and New Firm Yield Goal from NISP.

Participant	Approximate Firm Yield Goal (AF)
Central Weld County Water District (CWCWD)	8,400
Town of Eaton	1,300
Town of Erie	6,500
City of Evans	1,600
Fort Collins-Loveland Water District (FCLWD)	3,000
City of Fort Lupton	3,000
City of Fort Morgan	3,600
City of Lafayette	1,800
Lefthand Water District (LHWD)	4,900
Morgan County Quality Water District (MCQWD)	1,300
Town of Severance	1,300
Town of Windsor	3,300
TOTAL	40,000

1.3 NEED FOR THE PROJECT

The Participants in NISP have requested new firm yield (the yield under all hydrologic conditions, including dry years) to meet a portion of their projected demand until 2050 (Table 1-1). The requests for new firm yield are based on the Participants' analyses of their projected needs, the potential future demands as modeled by the District and scrutinized by the Corps, plus a 10 percent safety factor to account for uncertainty about future demand (Harvey Economics 2006; HDR 2007a). Some Participants face immediate water shortages; for others, shortages of firm water supply are expected over the next 10 to 20 years, as discussed later in this chapter and presented in Table 1-10 and

Figure 1-1. Service Areas of NISP Participants.

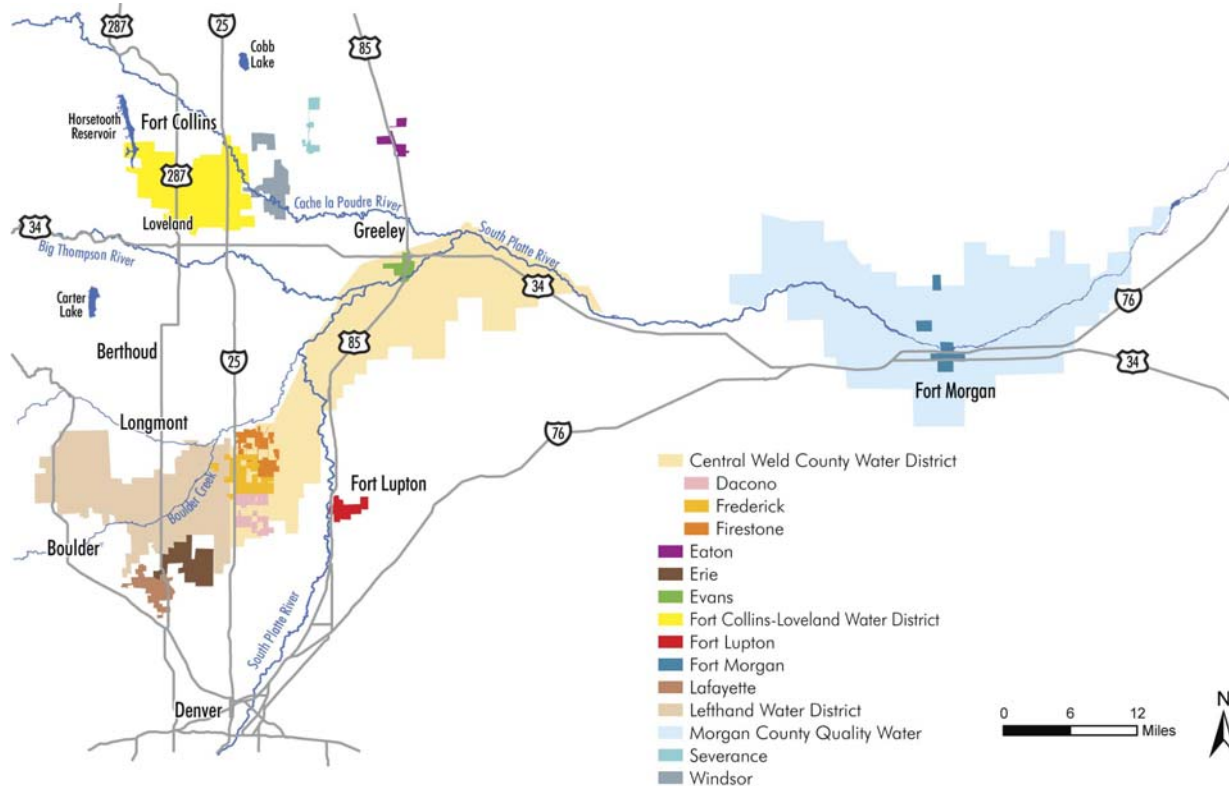


Table 1-11. Participants who face shortages before NISP is implemented would likely use strategies such as short-term leases for temporary water supplies (short-term leases are not a reliable long-term water supply).

The Participants are requesting 40,000 AF of new firm yield from NISP even though their combined shortage in 2025 is 41,120 AF, and their combined shortage in 2050 is estimated to be 70,020 AF. The requested firm yield is a blend of affordability and need. Although projections of water need are 1.75 times greater than the requested firm yield from NISP, the Participants are not requesting their entire future estimated shortage from NISP because most Participants anticipate that it would be too costly to seek the amount that would fully cover projected shortages.

1.3.1 The Northern Colorado Water Conservancy District

The Northern Colorado Water Conservancy District (District) was formed in 1937 under the Colorado Water Conservancy Act as the partnering agency with Reclamation for the development of the C-BT Project. The Conservancy Act authorizes the District to acquire and appropriate water, and to conserve, develop, and stabilize water supplies for domestic, irrigation, power, manufacturing, and other beneficial uses. As a result of this assignment, the mission of the District is to responsibly and effectively develop, conserve, and manage water resources to meet the current and future needs of its constituents.

Currently, the District encompasses about 1,600,000 acres of land in Northern Colorado. Deliveries from

the C-BT Project began in the late 1940s and have averaged about 210,000 AF of water each year. Water is stored in the upper Colorado River drainage in Lake Granby, and conveyed under the Continental Divide through the Adams Tunnel. C-BT water is stored on the East Slope in Carter Lake and Horsetooth Reservoir, from which deliveries are made to C-BT allottees.

Since completion of the C-BT Project, the District has continued its role in providing and protecting water supplies for the Northeastern Colorado region. Projects such as the Windy Gap Project, completed in the mid 1980s, the Southern Water Supply Project completed during the late 1990s, and the recently completed Pleasant Valley pipeline are examples of the District's continuing role in developing and promoting a more secure and flexible water supply for the region. The District's role as a regional entity that assists with developing water supplies allows the Participants an opportunity to join together to pursue a regional project, such as NISP, that will allow the Participants to meet their water supply goals in a cooperative manner with a common infrastructure.

Since 1966, Reclamation, the District, and other entities have undertaken several studies to plan for water needs in Northeastern Colorado. Phase I of these studies was completed between 1966 and 2002 to assess water needs in Northeastern Colorado. These studies ranged from long-term planning documents, projected water demands, possible facility locations, and feasibility studies.

Common to all of the large water resource projects the District has and continues to pursue is the involvement of project participants. Projects are developed to meet the needs of specific groups of water users. The Participants pay for the planning, implementation, and operation of the various projects. While the District would retain ownership

and operational responsibility of NISP, the Participants would own a pro rata contractual right to the project.

1.3.2 NISP Background

Through its role as a regional water provider, the District has expended considerable efforts in planning for the region's future water needs. Over the past 50 years of C-BT operations, the Northeastern Colorado region has transitioned from a rural economy based on agriculture to a more diverse urban economy. Accordingly, C-BT ownership has evolved from 85 percent agricultural ownership in 1957 to less than 30 percent today. This trend continues as agricultural ownership is reduced 2 to 3 percent annually.

C-BT ownership is in the form of units. Unitholders may be farmers, cities, water districts, industries, or others. In the past, the transfer of C-BT units from agricultural ownership to M&I ownership was one way that municipal water suppliers were able to increase their water supply. The yield of a C-BT unit varies from year to year based on hydrology. Based on analysis of hydrology and C-BT operations, including historical drought periods from 1950 to present, the District has determined that the firm yield of the C-BT Project is 0.6 AF per unit (ERO 2005b). During the latter half of the 1990s, C-BT units began to increase substantially in price. The cost increase was due in part to the decreasing availability of C-BT units for sale combined with a rapid increase in population and municipal ability to pay. In 2006, about 71 percent of C-BT ownership was in M&I use (including the municipally held ownership of NPIC) while 29 percent was in agricultural ownership. This trend of converting C-BT agricultural ownership to M&I ownership is expected to continue; however, an estimated 10 to 15 percent of the C-BT units will remain in

agricultural uses for the foreseeable future. Currently, about 14 percent to 19 percent of C-BT units (43,000 to 59,000 units) are estimated to be available for future transfer from agriculture uses to M&I uses.

Water development in the Poudre Basin has been studied since 1928 when Reclamation first studied the possibilities for building storage in the Poudre Basin. Reclamation conducted further investigations in 1954, 1959, and 1963.

In 1980, the Cache la Poudre Water Users Association filed for a 220,000 AF storage right for an on-channel reservoir. In 1985, seven-eighths of this conditional water right was transferred to the District. Since that time, the District has spent considerable effort in determining the feasibility of numerous options for storing unappropriated Poudre River water (MWH 2004).

Led by Congressman Hank Brown, who had convened a committee of local officials, water resource managers, and environmental organizations, 75 miles of the Poudre River were designated as wild and scenic in 1986, the first such river designated in the state under the 1968 Wild and Scenic Rivers Act. In the spirit of this designation compromise (which prevented nearly 90 percent of the river from future water development), an 8-mile reach below Poudre Park was left undesignated to allow for the possible future development of a water storage project. This lower stretch above the canyon mouth became the focus of studies in the mid-1980s for a potential reservoir site utilizing the water rights described above.

The Colorado Water Resources and Power Development Authority funded two studies between 1985 and 1990 to determine the feasibility of building storage reservoirs utilizing the Poudre River water rights. Both studies concluded that storage was feasible with a large mainstem, Grey

Mountain Reservoir, as the critical component. The District's early efforts at building a "Poudre Project" focused on a mainstem reservoir.

The Big Thompson River Basin and St. Vrain River Basin have also been considered for future water development. Previous investigations by the District have found limited potential for developing significant new yield from these basins.

In 1992, the District filed for conditional water rights associated with the South Platte Water Conservation Project (SPWCP) in the lower South Platte River Basin. The SPWCP was originally proposed to pump water from the South Platte River near the Town of Kersey north to an aquifer near the Town of Nunn. Water would then be pumped to local ditch companies, which would forgo river diversions and allow water to be exchanged up the Poudre River. Studies eventually concluded that the aquifer did not have the capacity or favorable characteristics to act as a storage vessel. Therefore the District began the study of conventional aboveground storage.

The combination of a project utilizing the Poudre Basin water rights and SPWCP became the basis for the initial planning of NISP. Previous studies by the District estimated that an integrated project would have the capability to provide sufficient yield to meet the Participants' requests (Table 1-1).

In 2000, the District prepared a municipal demand study based upon current and projected land use using the published comprehensive plans of local governments. The District's demand study estimated that municipal water use within the District would potentially increase to an ultimate demand of nearly 500,000 AF per year. Compared to approximately 200,000 AF of present use, this represented a 300,000 AF increase (NCWCD 2000). While some of this demand will be met by increased utilization of existing supplies and growth onto

existing irrigated lands with the conversion of agricultural water to M&I use, all of the expected future demand cannot be met by these means alone (MWH 2004).

Recognizing the limits on future availability of C-BT units and other existing sources, a group of water providers began to meet in 2000 to discuss the potential for developing a new regional water supply. In 2002, the Participant group agreed to formally move forward with NISP by funding an alternatives evaluation.

In 2004, the District completed its Phase II Alternative Evaluation Report for NISP (Phase II report) (MWH 2004). The objective of the Phase II report was to identify a preferred project that would provide adequate new firm yield for the Participants. In the Phase II report, a broad range of alternatives was analyzed systematically to determine the alternatives that could meet the Project need in a dependable and affordable manner, and in a way that minimizes environmental consequences.

1.4 OVERVIEW OF WATER SUPPLIES AND DEMANDS

The NISP Participants' existing water supplies include: direct flow from the Cache la Poudre, St. Vrain, and Big Thompson rivers; transbasin supplies from the Colorado River Basin; reservoir storage; and mutual ditch, irrigation, and reservoir company shares within the Cache la Poudre, St. Vrain, South Platte, and Big Thompson River basins.

The common water supply among all the Participants is the C-BT Project. As a supplemental water supply for the northern Front Range, the goal of the operation of the C-BT Project has been to provide a smaller amount of water in wet years when less supplemental water would be needed and more water in dry years when the native flows would be

reduced and more supplemental water would be needed. C-BT units are allocated as a percent of an AF every year. The quota (the AF of water/C-BT unit), or percent of an AF, is initially set in October and reevaluated in April by the District Board and can be increased later in the summer. Historically, C-BT quotas have ranged between 0.5 and 1.0 AF per unit; however, quotas are adjusted to actually deliver more water in dry years.

1.4.1 Sources and Yields of Current Water Supply

The sources and yields of the Participants' current water supplies are shown in Table 1-2. Annual yield from the NISP Participant supplies vary depending on available water each year and system losses. Average supplies are determined from historical yields, and dry year firm yields are determined from the drought period on record. The firm yields differ for each supply, depending on the priority of the water right in the river system providing the supply.

The determination of the Participants' existing water supplies and future demands was performed by Harvey Economics (2006). This study was begun in 2004 and most of the usage estimates were based on 1998 through 2003 usage rates. Although the Participants have continued to grow, the 1998 through 2003 usage rates are appropriate estimates of current usage rates for the Participants, as usage rates over short-time periods are influenced by weather and use restrictions.

Table 1-2. Participant Water Supplies.

Participant	Average Yield (AF)	Dry Year (Firm) (AF)	Source
CWCWD	10,179	8,465	C-BT and Windy Gap units and mutual company shares
Eaton	1,791	1,616	C-BT units, mutual company shares, and irrigation wells
Erie	5,044	2,145	C-BT and Windy Gap units, mutual company shares, and reservoirs
Evans ¹	9,319	6,932	C-BT and Windy Gap units and mutual company shares
FCLWD	9,486	8,156	C-BT units and mutual company shares
Fort Lupton	4,109	3,538	C-BT and Windy Gap units, mutual company shares, and direct flows
Fort Morgan	4,978	4,481	C-BT units, and direct flows for irrigation and Excel Beef
Lafayette	6,120	4,534	C-BT, mutual company shares, and reservoir storage
LHWD	6,350	4,712	C-BT and Windy Gap units, mutual company shares, and reservoir storage
MCQWD	2,552	2,512	C-BT units and direct flows
Severance	490	422	C-BT units, mutual company shares, and irrigation wells
Windsor	2,908	2,492	C-BT units and mutual company shares

¹Evans Ditch water (2,367 AF/year) currently is not available for potable use and is not included in the total.
Source: HDR 2006.

1.4.2 Service Areas and Current Water Use

The Participants' service areas include towns and small communities and surrounding rural areas in Boulder, Larimer, Morgan, and Weld counties (Figure 1-1). Most of the water supplied by the Participants, and the majority of anticipated future water supplies, is for residential uses. Many of the Participants also supply water for public, commercial and industrial uses, including parks, golf courses, schools, dairies, and beef and food processing plants such as Excel Beef and Leprino Foods. Participant water requirements in 2003, a drought year, are shown in Table 1-3.

1.5 WATER DEMAND

The Participants serve residential, agri-business, agricultural, M&I, and recreational users. The following sections provide information on population growth, historical water use, conservation

efforts, and projected future water requirements of the Project Participants.

1.5.1 Population Growth

During the 1990s, Colorado's economy was in the top five nationally, driven by the technology sector, tourism and economic diversification (Parker Colorado Economic Development Council 2003). From 1990 to 2000, the state added one million residents to its population. About 60 percent of this growth was attributable to in-migration (Colorado Office of Economic Development 2004). A large part of the growth between 1990 and 2002 occurred in the region where the NISP Participants are located. Boulder County experienced a 23 percent increase in population; Larimer County's population increased 41 percent; and Weld County's population grew by 54 percent. Some of these counties' growth was due to relatively higher housing costs in adjacent areas, particularly Boulder and Denver.

Table 1-3. Total Nonpotable and Potable Water Requirements for NISP Participants, 2003.

NISP Participant	Potable Deliveries	Nonpotable Deliveries	Total Deliveries	Total Requirements with Losses
	AF			
CWCWD	5,102	0	5,102	5,547
Eaton	577	15	592	713
Erie	1,474	80	1,554	1,786
Evans	1,572	1,225	2,797	3,690
FCLWD	5,732	0	5,732	6,368
Fort Lupton	866	1,796	2,662	2,954
Fort Morgan	2,619	841	3,460	3,708
Lafayette	3,478	325	3,805	4,079
LHWD	3,389	0	3,389	4,033
MCQWD	1,661	0	1,549	1,631
Severance	129	15	144	193
Windsor	1,609	0	1,609	2,040
Total	28,208	4,297	32,505	36,742

Note: 2003 was a drought year; potable and nonpotable water use was lower than would be expected during a normal year.

This growth is projected to continue over the next 50 years.

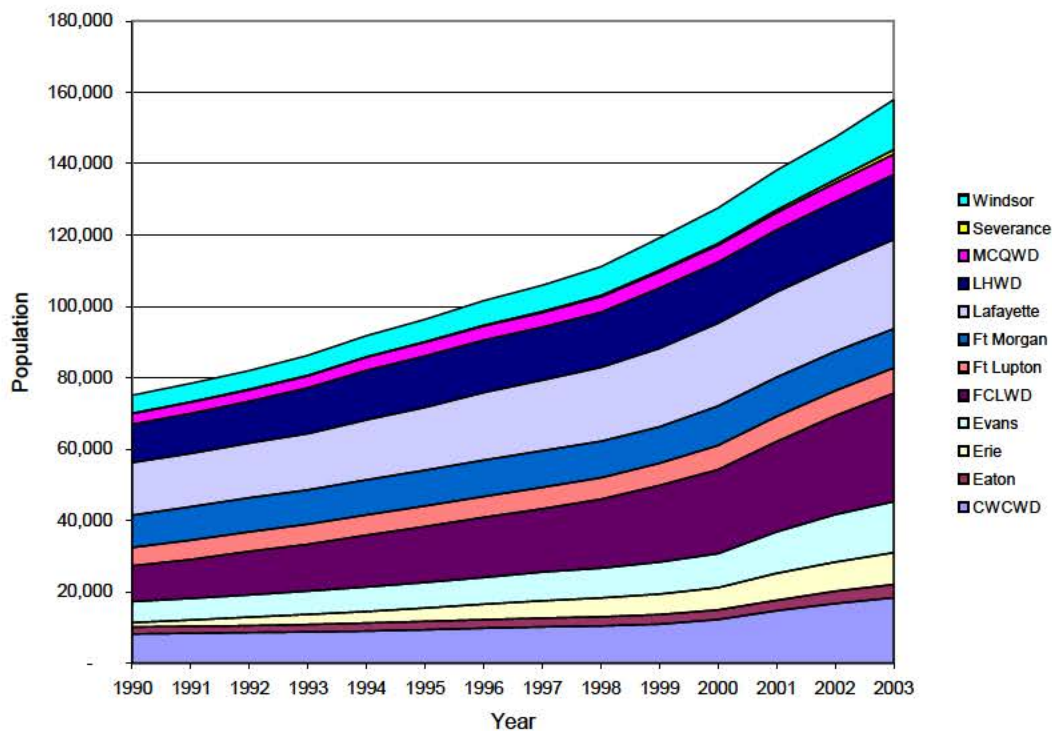
The 12 NISP Participants served water to 71,000 people in 1990, more than doubling to 153,000 by 2003, and 200,000 in 2007, an average annual growth rate of 6 percent (Figure 1-2) (Harvey Economics 2006).

The economy in northeastern Colorado historically has been based on agriculture. As the population has increased and the northeastern Colorado economy has grown, former agricultural uses have become M&I uses, and this trend is expected to continue. All of the NISP Participants have experienced population growth at varying rates. The population of Severance increased to 1,300, a tenfold increase from 1990 to 2003. The Town of Erie grew 700 percent from 1990 through 2003. The City of Fort

Morgan (1.7 percent population increase) and the MCQWD (1.3 percent population increase) experienced the lowest population increase of all the Participants over the same time period. The most heavily populated water suppliers in 2003 were the FCLWD with 30,400 residents and the City of Lafayette with 24,600 residents. The FCLWD and the City of Lafayette accounted for almost one-third of the total population of the NISP Participants (Harvey Economics 2006).

The population planning horizon examined as part of this Draft EIS extends to 2050. The NISP Participants' populations are projected to grow considerably over this planning horizon. Although population projections are not available for all NISP Participants, the projected population or numbers of taps from 2005 to 2050 for some NISP Participants are listed in Table 1-4 (some Participants estimate

Figure 1-2. Population Growth for Each NISP Participant, 1990 through 2003.



the number of taps expected to be issued, rather than projected population). The Participants' projected growth rates are based on regional and statewide population projections, planning estimates of various municipalities, and other economic factors as described in the Water Supply and Demands Study (Harvey Economics 2006).

Although the Participants' projected growth rates vary, average annual growth rates generally range from 2 to 5 percent per year.

Table 1-4. Population or Tap Projections for NISP Participants, 2005–2050.

Participant	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	Average Annual Growth Rate
Population Projections											
Erie ¹	11,600 ²	16,640 ³	22,270 ⁴	29,800 ⁵	40,680						3.97%-12.78%
Evans ¹	17,800	21,200	24,200	27,700	31,000	34,700	39,000	40,400	40,400	40,400	2.5%-4%
Fort Lupton ¹	7,900	8,900	10,100	11,400	12,800	14,500	16,300	18,400	20,800	23,500	2.5%
Fort Morgan ¹	11,400	12,400	13,500	14,600	15,900	17,300	18,900	20,500	22,300	24,300	1.7%
Lafayette ¹	25,650	28,200	30,740	33,290	35,830	36,190	36,190	36,190	36,190	36,190	<2%
Severance ¹	1,500	2,100	3,100	4,600	6,700	9,000	12,100	15,000	15,000	15,000	6%-8%
Windsor ¹	15,200 ⁶	21,400	26,600	31,800	36,900	42,100	47,300	52,500	57,600	60,000	2%-7%
Firestone ¹	7,100	11,500	15,900	20,300	22,500	24,800	27,000	29,200	31,400	33,600	1.07%-1.62%
Frederick ¹	6,700	12,100	16,000	19,000	22,000	24,500	26,500	27,500	28,000	28,500	1.02%-1.81%
Dacono ¹	3,400	5,760	8,120	10,480	12,840	15,200	17,550	19,920	22,280	24,640	1.11%-1.69%
Tap Projections											
CWCWD ⁷	2,000	2,500	3,000	3,300	3,600	3,900	4,200	4,500	4,800	5,100	0.8%-2.5%
Eaton ⁸	1,840	2,440	3,040	3,640	4,240	4,840	5,440	6,040	6,640	7,240	120 taps/year
FCLWD ⁸	12,650	15,650	18,650	21,650	22,000	22,000	22,000	22,000	22,000	22,000	3%-6.8%
LHWD ⁹	6,700	7,800	9,000	10,400	12,100	14,000	15,500	15,500	15,500	15,500	2.9%
MCQWD ⁸	2,200	2,800	3,200	3,500	3,800	4,100	4,500	4,800	5,100	5,400	1.3%

¹Projected population.

²Projected 2004 population. Erie does not have population estimates for each 5-year interval. Population projections are for the years indicated only.
Erie is expected to reach buildout by 2025.

³Projected 2007 population.

⁴Projected 2012 population.

⁵Projected 2017 population.

⁶Projected 2004 population.

⁷Projected number of residential taps.

⁸Projected number of taps.

⁹Residential tap equivalents.

1.5.2 Historical Water Requirements

The estimates of past water requirements for the NISP Participants include both potable and nonpotable deliveries. Potable water deliveries are typically made to residential and M&I customers as well as parks, golf courses and other public uses, depending on the economic and demographic makeup of the water provider's service area.

In 2004, nine of the 12 Project Participants delivered nonpotable water to customers for outdoor irrigation. Nonpotable deliveries are typically conveyed through existing ditch systems that previously served agricultural lands. Parks, school grounds, golf courses, and open space are increasingly served by nonpotable water systems to avoid drinking water treatment costs and to take advantage of available water resources. In addition, some of the Participants are encouraging dairies and other agricultural users to use nonpotable water supplies. Because nonpotable delivery systems are a relatively

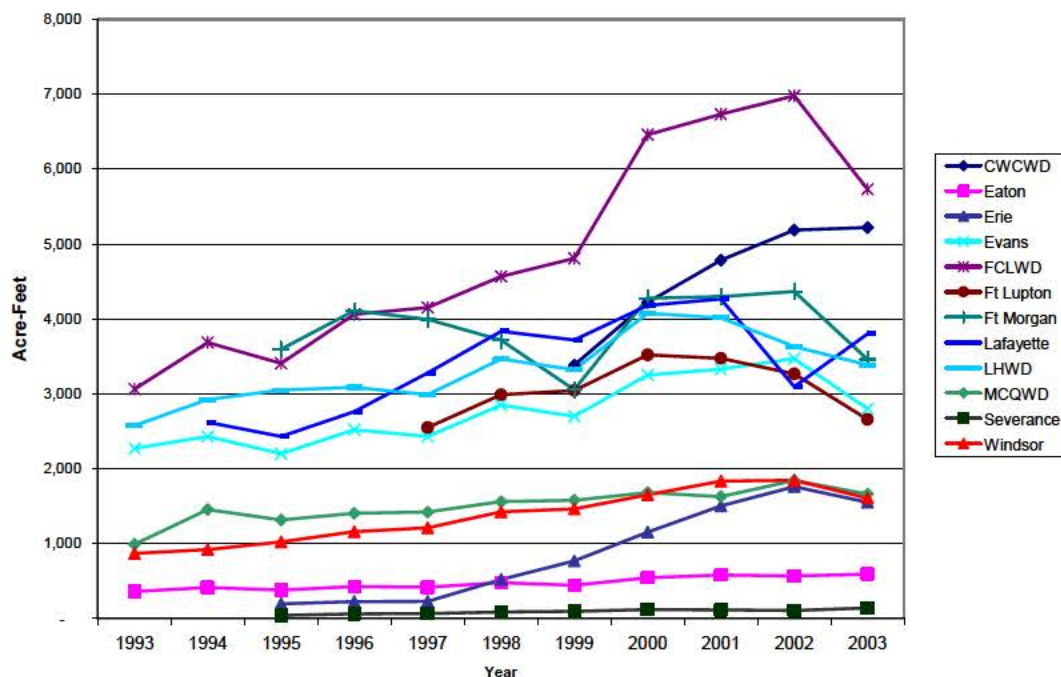
new practice, they do not have a well-documented history in northeastern Colorado.

The combined total water deliveries for all of the NISP Participants were almost 36,600 AF in 2001, the peak water delivery year to date. From 1998 to 2001, total water deliveries to NISP Participant users increased by about 28 percent. Figure 1-3 shows total water deliveries to customers for each Participant between 1993 and 2003 (Harvey Economics 2006).

1.5.3 Conservation

All of the NISP Participants have ongoing water conservation programs that have been implemented to educate users about their water supply and discourage unnecessary use of water on a long-term basis. Water conservation measures are programs consistently applied every year to reduce water demands. These ongoing measures are distinguished from more severe drought restrictions implemented

Figure 1-3. Total Water Deliveries to NISP Participants' Customers, 1993 through 2003 (AF).



temporarily to avoid a true water shortage. Drought restrictions are typically reserved by water resource managers for unusually adverse hydrologic conditions or for unexpected circumstances that threaten the ability of the water provider to meet its customers' requirements. Implementing drought restrictions on a long-term basis would harden the Participants' water supplies, meaning that the Participants would have no flexibility in a drought situation, and likely would not be able to deliver the necessary amount of water (Harvey Economics 2006). Conservation plays an important role in each NISP Participant's present and future water demand, and is therefore represented as a reduction in demand for NISP rather than as an additional source of water.

The Participants' ongoing water conservation programs are typical among water providers, with a stronger emphasis on price signals to promote efficient use. Almost all of the Participants' water conservation programs have an educational component that ranges from stuffing bills with water conservation reminders to websites, newspaper and television ads, and school programs. All of the Participants generally practice universal metering to keep track of water use patterns and to charge customers for the water they consume. The water price signal to customers is accentuated by the increasing block rate structure in place for almost all of the Participants in which those who use the most water pay more. In addition, five of the 12 Participants have an excess water use surcharge. Many Participants also commonly use leak detection, and repair or replace inefficient water mains, pipes, and meters.

A number of Participants have landscape ordinances and permanent outdoor watering restrictions in place. Water audits and the promotion of water efficient appliances also are practiced by a number of Participants. Certain Participants have

nonpotable irrigation systems or a water reuse system in which wastewater is used for irrigation.

1.5.3.1 Participants' Historical Water Use Compared to Regional Water Users

The annual combined gallons per capita per day (gpcd) for the Participants from 1998 to 2003 indicates usage rates that fluctuate largely with weather and water use restrictions during times of drought. For that same period, the average for all 12 Participants was 161 gpcd (Table 1-5). By comparison, Denver Water's average during this same period was 201 gpcd.

Information on gpcd for 1998 through 2003 was used to estimate the average gpcd for each Participant. The 1998 to 2003 average gpcd was typically slightly greater than the long-term average for a Participant.

From 1998 to 2003, most Participants' potable water use fluctuated, depending upon weather, and almost all Participants experienced a substantial decline in use of potable water in 2003 due to drought restrictions (Table 1-6). Additionally, each Participant's water use pattern is unique because the mix of customer types varies; the presence of large water users such as dairies or industry, new large lot homes versus small in-town lots, and the presence of

Table 1-5. NISP Participants' gpcd Compared to Denver Water.

Year	NISP	Denver Water
1998	170	213
1999	159	204
2000	180	220
2001	171	211
2002	157	192
2003	127	166
Average, 1998–2003	161	201

Table 1-6. Total Potable gpcd Use for Each NISP Participant, 1998–2003.

Participant	1998	1999	2000	2001	2002	2003	Average 1998–2003
CWCWD ¹	NA	163	162	152	172	NA	162
Eaton	167	150	179	173	144	139	159
Erie	104	125	155	180	179	143	147
Evans	198	174	197	167	151	98	164
FCLWD	204	194	240	233	221	164	209
Fort Lupton	127	121	128	120	119	109	121
Fort Morgan	186	153	204	192	181	102	170
Lafayette	151	137	148	147	102	126	135
LHWD	200	176	213	207	183	167	191
MCQWD ²	211	201	204	193	210	157	196
Severance	167	168	184	135	88	88	138
Windsor	157	143	149	147	139	102	140
Total NISP Average	170	159	180	171	157	127	161

¹Excludes Aurora Dairy and other large commercial water users.

²Excludes Leprino Foods, dairies, and other large water users.

commercial activity demonstrate the water use patterns of a single Participant. For example, CWCWD provides water to various agricultural and dairy users such as Aurora Dairy. Total per capita per day water use (including dairies and other large water users) for CWCWD was about 335 gpcd from 1999 through 2003; however, residential water use by CWCWD averaged 162 gpcd, which is comparable with other Participants.

The water providers with lower gpcd, including Fort Lupton, Erie and Lafayette, are largely bedroom communities with a higher number of persons per tap than other water providers, which tends to lower potable gpcd.

Several NISP participants, including CWCWD, MCQWD, and FCLWD, provide potable water supplies to dairy operations, which require relatively

large volumes of potable water. Weld County had approximately 58,000 total head of dairy cattle in 2005 (NASS 2005). While water use requirements within a dairy can vary considerably, studies in Idaho, Texas, and New Mexico suggest that lactating cows typically require about 25 to 50 gallons per day for drinking purposes. Dry and replacement cattle (which make up about one-half of the dairy herd) drink about 10 to 15 gallons of water per day. Sanitary requirements, including washing the cows and milking equipment and flushing the milking parlor and holding pens, requires about the same amount of water as is directly consumed by the lactating cows (DPNM 2006; USGS 1996; IASCD 2004). Consequently, a dairy operation with 1,000 cattle would be expected to need between 30,000 and 60,000 gallons of potable water per day. This

corresponds to an annual volume of roughly 34 to 64 AF per year for a typical 1,000 head dairy operation.

Historical Water Use Patterns in Northern Colorado. Two sources of information offer a comparison of historical water use with current water use patterns in Northern Colorado: the original Windy Gap EIS, which was prepared in the late 1970s and early 1980s (NCWCD 1981); and the Northern Colorado Water Conservancy District's Regional Water Supply Study (NCWCD 1991).

The Windy Gap EIS focused on water use patterns of the original participants of that project: Boulder, Estes Park, Greeley, Longmont, Loveland and the Platte River Power Authority. Although none of these water providers are Participants in NISP, geographically they are representative of the NISP Participants. The average water use of the Windy Gap participants, excluding Platte River Power Authority, was 250 gpcd in the 1980s, compared to an average of 161 gpcd for the Participants in NISP from 1998 through 2003.

The District's 1991 Regional Water Supply Study included estimates of actual water use patterns for water providers in Northern Colorado and projections of future water use for municipal and industrial water providers from the Northern Denver Metropolitan area in Boulder, Larimer and Weld counties, including many of the Participants (Table 1-7).

The average gpcd for these Participants for 1998 through 2003 is about one-third less than the average that those same Participants exhibited in 1988. This significant reduction in water use indicates that the conservation efforts already undertaken by Participants have been effective. It also suggests that additional savings will be more difficult and costly to achieve.

Table 1-7. Water Use Pattern for Selected NISP Participants, 1988.

NISP Participant	1988 gpcd
CWCWD	395
Eaton	183
Erie	389
Evans	216
FCLWD	199
Fort Lupton	326
Fort Morgan	280
LHWD	177
MCQWD	245
Windsor	140
Average	255

Typically, water providers and their customers are motivated to take the first steps in conservation programs that achieve the largest savings at the least incremental cost. The Participants have reduced use by implementing relatively inexpensive water saving measures such as public education, watering restrictions, low-flow fixture requirements, and landscaping regulation for new construction.

Development of a Water Use Benchmark for NISP Participants. A water use benchmark applicable to the Participants may be useful in evaluating Participants' existing water use patterns to determine if additional water conservation is a reasonable expectation. However, the establishment of such a benchmark is a challenge for the following reasons:

- Numerous jurisdictions, including the states of Texas, California, and Utah, have attempted to establish water conservation benchmarks, but each developed that benchmark in a unique manner suitable to its own purpose. No single, commonly accepted means for establishing such a benchmark is known to exist as of 2005.

- Many measures of water use exist, and the calculation of water use is performed differently by agencies and jurisdictions. For example, water use can be measured by gpcd, gallons per tap per day, gallons per household per day, residential water use per capita per day, and so on. Further, the point of measurement, i.e., public water supplies versus all water supplies, or population within the city limits versus service area population, is also not uniform.
- Benchmarks are best established by following comparability criteria as outlined by the Environmental Protection Agency (EPA) in its water conservation guidelines (EPA 1998a).

Establishing a benchmark requires judgment based upon comparable areas and an understanding of the site-specific circumstances of the Participants.

Regional average gpcds provide a starting point for establishing a NISP water use benchmark. The Statewide Water Supply Initiative (SWSI) found that Colorado statewide gpcd averaged between 206 and 332 gpcd, with the South Platte River Basin as the lowest average in the state at 206 gpcd (CDM 2005). The EPA reports an average water use of 242 gpcd for the entire upper Colorado River Basin (EPA 1998b). This same EPA report assigns a 194 gpcd to the South Platte River Basin. A Western Resource Advocates report indicates an average of about 229 gpcd for 13 large western U.S. cities in 2001 (Western 2003). Another potential benchmark can be extracted from U.S. Geological Survey water use data produced in the year 2000. This federal agency gathers water supply, demand and population data for counties throughout the U.S. every 5 years. In the year 2000, Colorado's portion of the South Platte River Basin used an average of about 200 gpcd (USGS 2000).

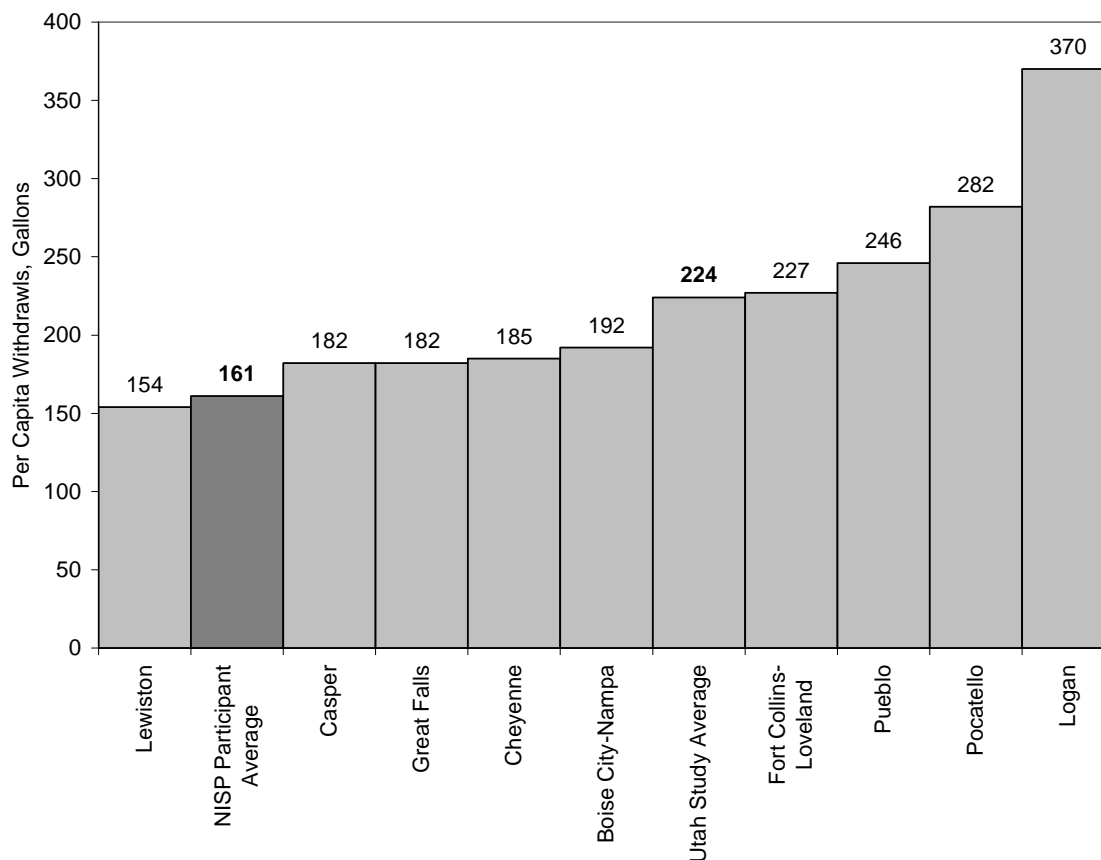
Another potential water use benchmark comes from a study that provides water use information for 25 cities in the western U.S. of various sizes and locations (Utah Economic and Business Review

2005). These 25 cities had an average of 243 gpcd. For this study, the average gpcd of cities of less than 301,000 in population and cities within plus or minus 25 percent of the precipitation of the Fort Collins/Loveland area was 224 gpcd (Figure 1-4).

For comparison, three cities in the vicinity of the NISP Participants, Fort Collins, Greeley, and Loveland, also had water use in 2002 similar to the Participants. Fort Collins 2000 water use was 198 gpcd (City of Fort Collins 2004). Greeley's 2000 water use was 220 gpcd, and Loveland's 2000 water use was 204 gpcd (ERO 2005b).

Denver Water had an average potable gpcd usage of 201 gpcd between 1998 and 2003 (Harvey Economics 2006). Denver, which also could serve as a potential benchmark, has a well developed water conservation program and is considered by many to be an example of strong conservation along Colorado's Front Range. Denver Water's comparability is somewhat limited, however, because it is a much larger metropolitan area with different financial resources than the Participants. Denver Water data also include parks and other outdoor irrigation requirements, whereas the Participants' data include only potable supplies, excluding a modest portion of nonpotable use for irrigation. Based upon these various potential water use benchmarks, a range of 194 gpcd to 224 gpcd was selected as a regional water use benchmark. A range is appropriate because these prior studies measure water use in somewhat different ways. For instance, some of the regional usage estimates likely include nonpotable water deliveries, while others do not.

Figure 1-4. Average gpcd for Selected Cities.



Comparison of Benchmark to NISP Participant Usage. The average potable water use of the NISP Participants from 1998 through 2003 was 161 gpcd. If nonpotable deliveries are also included, total water use by NISP Participants is about 15 percent greater, or approximately 189 gpcd. Both the potable-only use and the combined potable and nonpotable use by NISP Participants are below the regional benchmark.

Participants showing higher water use are rural water districts that serve large agribusinesses whose effects on water use patterns are magnified by a relatively small population base. The Participants have implemented successful conservation measures

as evidenced by water use patterns that are below regional averages. Additionally, the Participants have reduced their average gpcd for 1998 through 2003 by about one-third relative to their 1988 gpcd. All Participants have active conservation programs in place and each includes a variety of measures. Programs focusing on price signals appear to be emphasized by Participants.

1.6 FUTURE WATER REQUIREMENTS

The Participants' projected future water demands were calculated based on existing firm yield, which

Table 1-8. Combined New Water Requirements Beyond 2004 Firm Annual Yield, 2005–2050.

Year	Combined Water Requirements Beyond 2004 Firm Annual Yield (AF)
2005	-2,950
2010	9,070
2015	20,100
2020	31,370
2025	40,670
2030	47,370
2035	54,470
2040	58,870
2045	62,270
2050	65,170

Firm annual yield for 2004 was estimated to be 50,005 AF for the 12 Participants combined.

is the yield that would be available to a Participant during a drought (Table 1-8 and Table 1-9).

Between 2005 and 2010, the combined total future water demand for the NISP Participants will exceed their combined existing annual firm yield (50,005 AF) (Table 1-2). By the year 2025, the excess of combined demands over current supplies will exceed 40,000 AF (Figure 1-5 and Figure 1-6), and 2025

projected demand is 90,700 AF. The NISP Participants have requested 40,000 AF in combined new firm yield from NISP. From a combined standpoint, the NISP Participants are projected to need the full yield and storage from NISP no later than 2020. The NISP Participants will need additional supplies from that point forward.

Table 1-9. Projected Total Raw Water Requirements (AF).

Participant	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
CWCWD	6,500	9,300	11,700	13,800	15,600	17,200	18,900	20,200	21,400	22,600
Eaton	790	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400	2,600
Erie	2,500	4,400	5,900	7,400	8,900	8,900	8,900	8,900	8,900	8,900
Evans	4,600	5,900	7,000	8,400	9,700	11,100	12,800	13,300	13,300	13,300
FCLWD	9,300	11,500	13,600	15,800	16,000	16,000	16,000	16,000	16,000	16,000
Fort Lupton	4,100	4,200	4,400	4,700	5,000	4,200	5,600	5,900	6,300	6,800
Fort Morgan	5,400	6,200	6,600	6,900	7,300	7,700	8,100	8,600	9,100	9,600
Lafayette	4,500	5,500	6,500	7,500	8,500	8,600	8,600	8,600	8,600	8,600
LHWD	4,200	4,900	5,700	6,600	7,600	8,800	9,800	9,800	9,800	9,800
MCQWD	2,200	2,200	2,500	2,700	3,000	3,200	3,400	3,600	3,800	4,000
Severance	300	500	700	1,000	1,500	2,000	2,700	3,300	3,300	3,300
Windsor	2,700	3,500	4,300	5,200	6,000	6,800	7,700	8,500	9,400	9,700
Total¹	47,090	59,100	70,100	81,400	90,500	96,300	104,500	108,900	112,300	115,200

¹Includes accounting for losses.

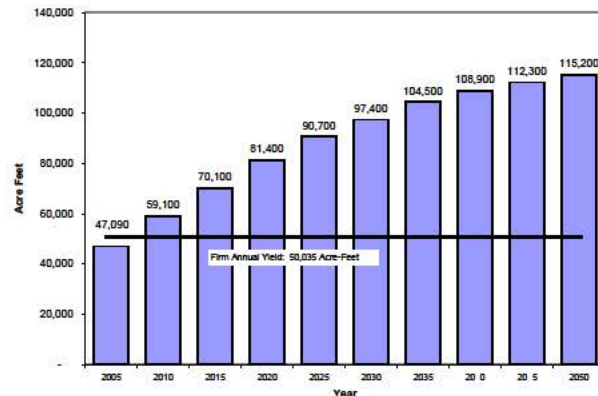
1.6.1 Demand Projection Safety Factor

A safety factor of 10 percent was added to the firm yield demand projections (Table 1-11). The safety factor is intended to account for faster or higher future demands than those projected and unforeseen events that could rapidly diminish supplies. Also, to account for inaccuracies in the hydrologic modeling, a 5 percent safety factor was added to the NISP demand node in the hydrologic model (HDR 2007b). As a result, this 5 percent safety factor is effectively added to projections of impacts based on output from the hydrologic model, except as noted otherwise in the supporting documentation for the EIS.

1.7 PARTICIPANT WATER SUPPLY AND DEMANDS

This section discusses the existing water supply, growth and population trend, water demand, and need for water for each Participant. A more detailed discussion is included in the Water Supply and Demands Study (Harvey Economics 2006), the Phase II report (MWH 2004), and reviews of these reports conducted by HDR and BBC under the direction of the Corps (HDR 2007a, 2006; BBC 2005). The discussion of each Participant's water supplies and demands includes a discussion of potable and nonpotable water deliveries. The total water requirements for the NISP Participants include both potable and nonpotable water deliveries plus an accounting for system losses. Except where indicated, future water needs projections are based on total water requirements, including potable and nonpotable water requirements.

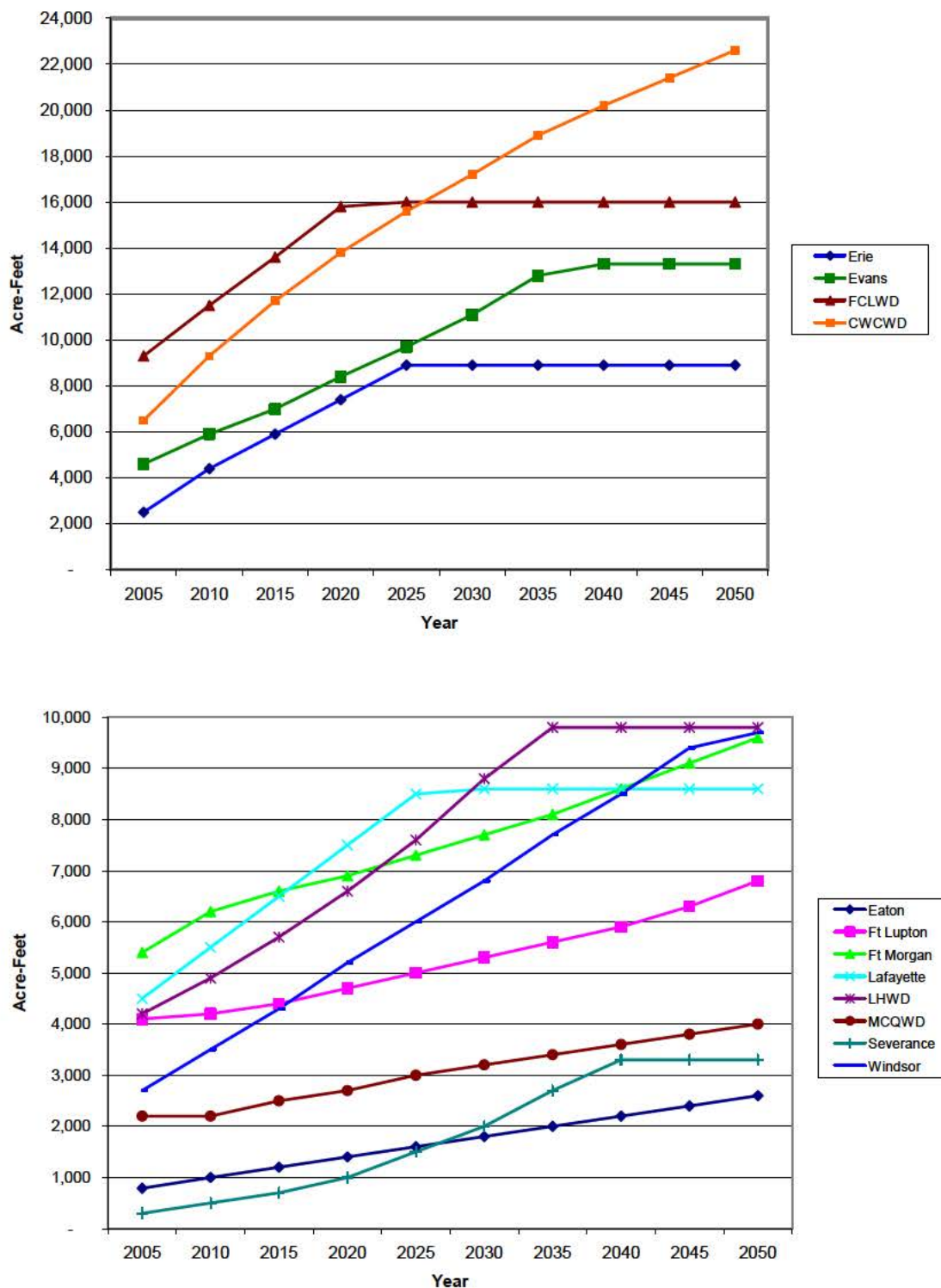
Figure 1-5. Combined Future Water Demand and Current Annual Firm Yield for NISP Participants.



1.7.1 Central Weld County Water District

The Central Weld County Water District (CWCWD) was created in 1965 to serve a large rural portion of Weld County. The CWCWD's total service area is about 250 square miles generally located south of Greeley and spanning the South Platte River to the area along I-25 south of Dacono. The CWCWD supplies water to rural customers within its boundaries, and provides only treatment (not water supplies) to several communities within its boundaries. The towns for which CWCWD treats water, but does not provide water supplies must provide their own firm water supplies to the CWCWD for treatment. This demand evaluation addresses CWCWD's rural customers' historical and future water needs, and the historical and future water needs of Firestone, Frederick and Dacono. The CWCWD does not supply any nonpotable water; therefore, this discussion of CWCWD's water requirements includes potable uses only.

Figure 1-6. Total Projected Water Requirements by NISP Participant, 1998–2050 (AF).



Existing Water Supply. The combined firm water supply in 2005 for the CWCWD rural customers, Firestone, Frederick, and Dacono is 8,465 AF as follows: the firm water supply that serves CWCWD's rural customers is 2,786 AF; Firestone's firm water supply is 2,487 AF; Frederick's firm supply is 2,142 AF; and Dacono's firm supply is 1,050 AF (Harvey Economics 2006). The primary sources of water owned by CWCWD and used to serve its rural customers are C-BT Project water, a small number of ditch shares in the Greeley-Loveland Irrigation Company, and 1 unit of Windy Gap water. The CWCWD does not have a firm source of supply for reuse because 99 percent of its water supply is from the C-BT Project, which is not reusable. Additionally, because CWCWD serves primarily rural customers with its Windy Gap water and because CWCWD does not operate a wastewater facility, there are no plans for reuse of Windy Gap water. In addition to the water owned by CWCWD, it receives, treats, and delivers C-BT water to eight small communities—Dacono, Kersey, Milliken, LaSalle, Gilcrest, Platteville, Aristocrat, and in emergencies, Left Hand Water District.

In 2005, CWCWD began providing water to Firestone and Frederick. The towns of Firestone, Frederick, and Dacono have applied through CWCWD for additional water supplies from NISP. Firestone and Dacono's source of water is from C-BT, and Frederick's primary water source is from C-BT with additional water from reservoir storage rights and various ditch shares (HDR 2006).

Growth and Population Trend. CWCWD rural service area population was estimated at about 5,200 in 2002. Between 1999 and 2002, the number of taps in the CWCWD rural service area grew at an average annual rate of 8.2 percent, or a total of about 27 percent.

The 2004 population of Firestone was estimated to be 6,650. Total water taps increased by more than 400 percent, or at an average annual rate of 22 percent, from 1996 through 2004. Annual growth rates have fluctuated since 1990, ranging from 3.9 percent in 1997 to 66.6 percent in 2001.

The CWCWD supplies water to the portion of Frederick east of I-25; only the portion of Frederick east of I-25 is included in this summary of historical and future water demands. The 2005 population of the portion of Frederick east of I-25 was estimated to be 6,700. The population of the portion of Frederick east of I-25 grew by more than 400 percent from 1990 through 2003, at an average annual growth rate of 14 percent. Annual growth rates have fluctuated since 1990, ranging from a decrease of 5.6 percent in 1993 to an increase of 63.6 percent in 2000.

Dacono's 2005 population was estimated to be 3,400. Between 1991 and 2005, the total number of taps increased by 407, or 41 percent. The annual growth rate for taps has varied from zero percent per year from 1992 through 1994 to 7.9 percent in 2005.

Current Water Demand. For the CWCWD's rural customers, nonresidential demands accounted for nearly two-thirds of total CWCWD demand in 2002. Nonresidential demand is mostly attributable to various agricultural and dairy users, with Aurora Dairy and Fort St. Vrain Power Generation representing the largest users. Total 2002 water demand for the CWCWD's rural residential and nonresidential customers was about 2,800 AF. Residential water use for the CWCWD's rural users was about 162 gpcd from 1999 to 2002. Total water use averaged almost 500 gpcd for the same period, but two-thirds of CWCWD rural customers' water demand was for agricultural and industrial users.

Firestone tap and water use data prior to 1996 are unavailable. Total potable water requirement in 2004 was 1,221 AF. From 1996 to 2004, residential

users accounted for about 85 percent of Firestone's customers. Prior to 1996, Firestone did not serve any commercial customers. Potable water demands for Firestone rose by 323 percent from 1996 to 2004. Total water use per capita has averaged 163 gpcd from 1996 through 2004. Usage rates dropped in 2003 and 2004 as a result of drought-related restrictions. No trends in per capita use rates are apparent from 1996 to 2004.

The total water requirement for the portion of Frederick east of I-25 was 965 AF in 2003. Total water requirements increased by 365 percent from 1990 through 2002, or at an average annual rate of 14 percent, and fell slightly in 2003. The portion of Frederick east of I-25 reached a peak total water requirement of 993 AF in 2002.

The total water requirement for Dacono in 2005 was 442 AF. Total water requirements ranged from 318 AF in 1991 to 442 AF in 2000 (Harvey Economics 2006).

Projected Water Demand. The population in the rural portions of the CWCWD service area is expected to reach about 16,000 by the year 2050 based on the estimated growth in residential taps (Harvey Economics 2006). To arrive at projected residential demand, historical residential use patterns were analyzed. Residential taps are expected to grow at an annual rate of about 4.6 percent until 2010, and then decline over time to about 1.2 percent by 2050. Projections of future nonresidential demands are based on the continuation of the historical average of 3.5 new taps per year. Total water requirements for the CWCWD's rural customers are estimated to be 5,900 AF per year by 2050.

Firestone is expected to grow from a population of about 7,100 in 2005, to 22,500 in 2025, to about 33,600 in 2050. Total water requirements are expected to increase from about 1,300 AF in 2005,

to about 4,000 AF in 2025, and about 6,000 AF in 2050.

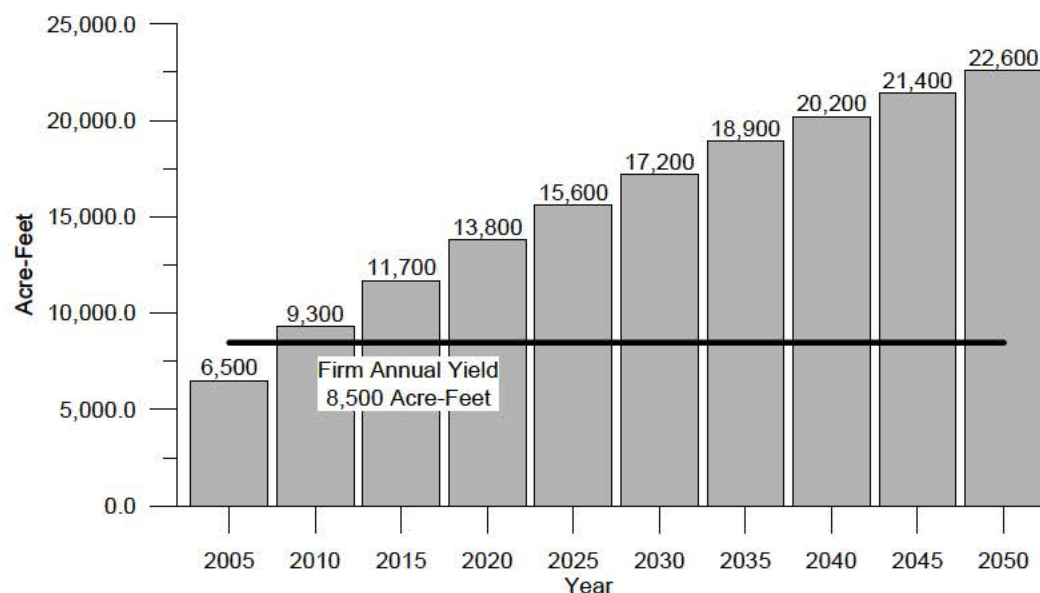
The population of the portion of Frederick east of I-25 is expected to grow from 6,700 in 2005, to 22,000 in 2025, to about 28,500 in 2050. Total water requirements for the portion of Frederick east of I-25 are estimated to increase from about 1,510 AF in 2005, to 6,380 AF in 2050, an increase of 4,870 AF. Total water requirements are expected to increase by 323 percent from 2005 through 2050, at an average annual rate of 3.3 percent.

The population of the City of Dacono is expected to increase from 3,400 in 2005, to 24,650 in 2050. It is expected that the population will increase at a rate of about 5,600 per decade. Total water requirements for Dacono are estimated to be 2,200 AF in 2025 and 4,350 AF in 2050.

The total water requirement for the rural customers in CWCWD, Firestone, the portion of Frederick east of I-25, and Dacono are expected to increase by more than 250 percent, or 16,000 AF from 2005 through 2050, at an average annual rate of 2.8 percent. The total water requirement for the CWCWD and these three communities is expected to increase from 6,450 AF in 2005, to 15,620 AF in 2025, to about 22,600 AF in 2050 (Harvey Economics 2006) (Figure 1-7).

Water Need. CWCWD's existing water supplies are sufficient to meet current water needs during average years of precipitation. Beginning in 2005, water demand could exceed available firm water supplies during dry years, depending on C-BT deliveries. Projected water demand exceeds the firm supply by about 7,100 AF in 2025, and by 2050 a shortage of about 14,200 AF is anticipated. The CWCWD has requested 7,100 AF from NISP. The firm yield CWCWD has requested from NISP would meet 100 percent of the CWCWD's projected 2025

Figure 1-7. Comparison of Future Water Demands with 2004 Firm Annual Yield, CWCWD, 2005–2050.



shortage and about 50 percent of the CWCWD's projected 2050 shortage.

The CWCWD also is a participant in the Windy Gap Firming Project (WGFP). Firming the CWCWD's Windy Gap unit would provide about 100 AF of water, or less than 2 percent of CWCWD's additional 2050 water supply needs (ERO 2006a). For this analysis, potential WGFP water is not considered part of CWCWD's current firm yield. As described in Section 1.8.1, the CWCWD would face a water shortage even if both NISP and the WGFP were constructed.

1.7.2 Town of Eaton

The Town of Eaton is located on U.S. 85, about 6 miles north of Greeley, and about 3 miles south of Ault. Eaton historically was an agricultural community on the Great Western Railroad. Eaton provides potable and nonpotable water primarily to residential and some nonresidential water users. Eaton does not provide water to any large commercial or industrial water users. Eaton's

service area includes the main part of town, four subdivisions—Hawkstone, Eaton Commons, Maplewood, and Govern Ranch—which were annexed in 2000, and about 640 acres of parks and open space (Harvey Economics 2006).

Existing Water Supply. Eaton's current firm water supply is 1,616 AF per year. Eaton's water supply is owned by Eaton and treated and supplied by the North Weld County Water District (NWCWD). To account for diversion and treatment plant losses, Eaton is responsible for providing water rights for 110 percent of deliveries made by the NWCWD (Harvey Economics 2006). Eaton owns C-BT units in the North Poudre Irrigation Company (NPIC), Windsor Reservoir Company, and the Larimer and Weld Canal. Eaton has nonpotable irrigation wells that currently yield 20 AF per year, and are expected to yield 645 AF per year in 2050. The nonpotable irrigation well water has not been included in the total existing water supply for NISP.

Growth and Population Trend. Eaton's population grew from 1,959 in 1990 to 3,702 in

2003, and since 1980 has had an average annual growth rate of about 1.8 percent. Eaton's largest period of growth was between 2000 and 2003, when Eaton's population grew by about 38 percent (an average annual growth rate of 11 percent), from 2,690 to 3,702 (Harvey Economics 2006).

Current Water Demand. Eaton serves primarily residential users. In 1990, Eaton's total potable water deliveries were 368 AF, and total potable deliveries increased to 577 AF in 2003. Between 1990 and 2003, total potable water use increased by 57 percent, or at an average annual rate of 4 percent. In recent years, water demand has remained fairly constant, probably due to the drought. From 1990 to 2001, Eaton's total potable deliveries increased at an average annual rate of 4.1 percent (Harvey Economics 2006).

Eaton's potable per capita water use decreased from 167 gpcd in 1990 to 139 gpcd in 2003. Eaton's average potable per capita water use was 160 gpcd over this 13-year period.

Nonpotable supplies are used to irrigate about 40 acres of parks and open space within two subdivisions that have dual use systems. Eaton does not currently meter nonpotable deliveries; but nonpotable deliveries were estimated to be about 15 AF in 2003 (Harvey Economics 2006).

Eaton's total water requirements, including nonpotable water and system losses, increased from 444 AF in 1990 to 713 AF in 2003, an increase of 61 percent (Harvey Economics 2006).

Projected Water Demand. The number of taps in the Town of Eaton is expected to increase at a rate of 120 taps per year. In 2005, Eaton was estimated to have about 1,840 taps. By 2025, the number of taps in Eaton is expected to increase to 4,240, and by 2050, the number of taps in Eaton is expected to grow to 7,240.

Eaton's total water requirements, including potable, nonpotable, and system losses, are expected to increase from 790 AF in 2005 to 1,600 in 2025, and 2,600 in 2050 (Harvey Economics 2006) (Figure 1-8).

Water Need. Eaton currently has sufficient water to meet its water demands during average years of precipitation. It is projected that in 2010, Eaton will face a water shortage of about 30 AF of firm supply. In 2025, it is projected that Eaton will face a water shortage of about 630 AF, and in 2050, Eaton is expected to face a water shortage of 1,600 AF.

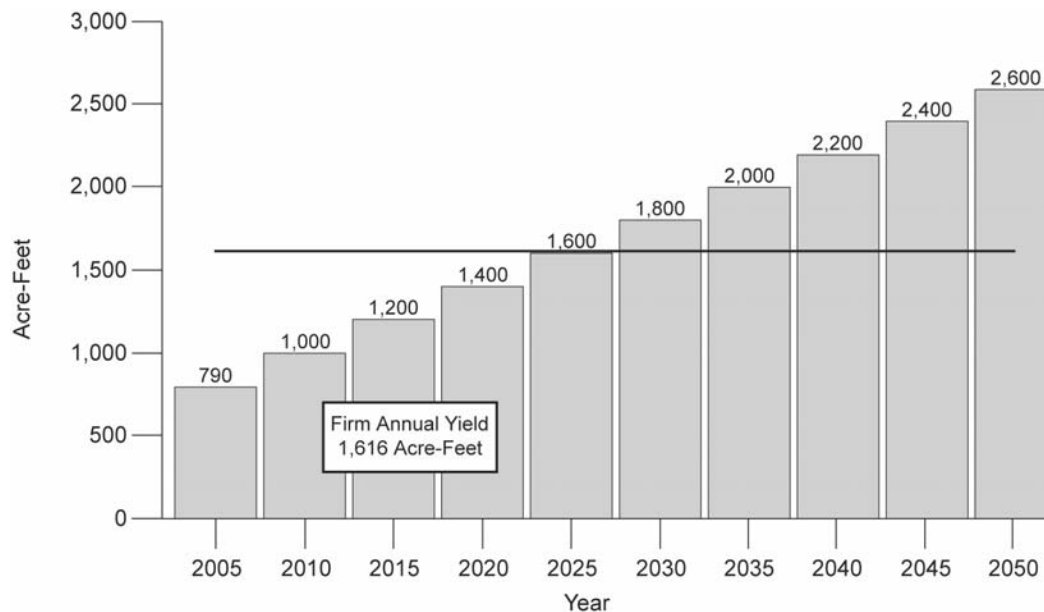
Eaton has requested 1,300 AF of new firm supply from NISP. This new firm supply would cover Eaton's projected shortage until about 2045. The water Eaton has requested from NISP would cover about 81 percent of the projected water supply shortfall in 2050.

1.7.3 Town of Erie

The Town of Erie is just north of the City of Lafayette. Prior to 1995, the Town of Erie was small and rural in nature. Considerable growth occurred after 1997 and continues to the present. Erie is a bedroom community for the Denver metropolitan area.

Existing Water Supply. Erie's water supply has grown sharply over the last 10 years to keep pace with population growth. Since 1992, Erie has purchased C-BT Project water, which currently provides more than 90 percent of Erie's water supply. Other water sources include the ownership of 7 units of Windy Gap water and planned acquisition of 13 additional units of Windy Gap water, reservoir storage rights, and various ditch shares. The current estimated firm annual water supply for the Town of Erie is 2,145 AF.

Figure 1-8. Comparison of Future Water Demands with 2004 Firm Annual Yield, Town of Eaton, 2005–2050.



Growth and Population Trend. Erie’s population grew from about 1,260 in 1990 to 6,300 in 2000; population in 2004 was about 10,390. From 1990 to 2004, Erie’s population increased 729 percent with a 744 percent increase in the number of housing units.

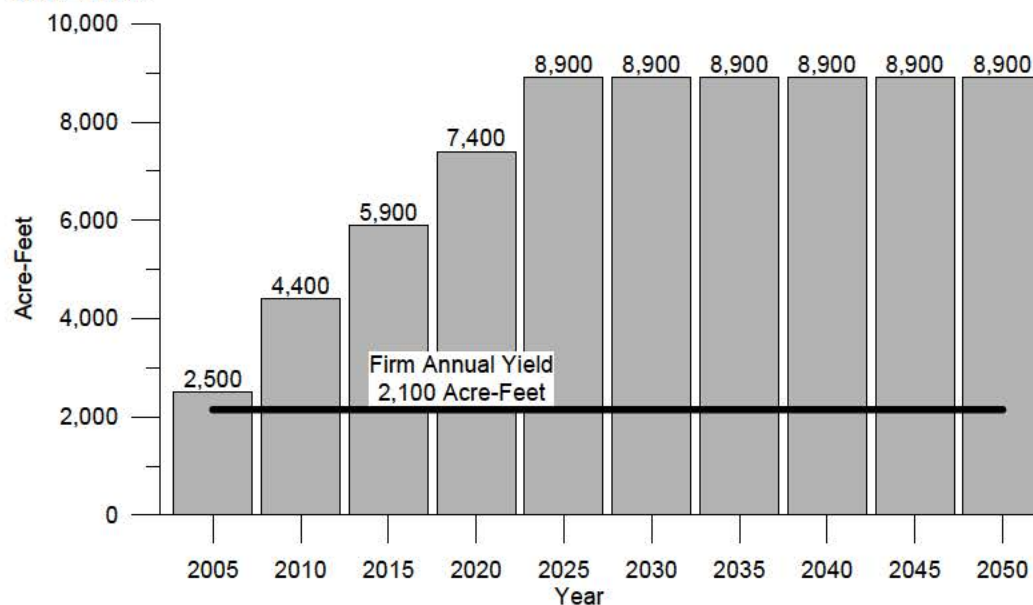
Current Water Demand. Encompassing about 14 square miles, the Town of Erie and its water department serve most customers within its service area. The LHWD is temporarily serving a portion of Erie’s service area. No large industrial or other large water users are served (Harvey Economics 2006). From 1997 through 2003, total water deliveries for the Town of Erie increased sixfold. In 2002, residential water use comprised 76 percent of total water sales, and residential use has averaged 88 percent of total water sales from 1997 through 2004. In 2003 and 2004, commercial water sales accounted for more than 15 percent of total water sales. The Town of Erie initiated nonpotable water use in 2001 and averaged about 80 AF of deliveries between 2001 and 2003. Total water requirements for the Town of Erie increased from 229 AF in 1995 to a

high of 2,025 AF in 2002. From 2000 to 2003, total water use averaged 164 gpcd and residential water use averaged 129 gpcd.

Erie’s nonpotable demands include watering the green space for parks, ball fields, and a golf course, although the golf course uses some of its own water for irrigation. Erie initiated nonpotable water use in 2001, and averaged about 80 AF of deliveries per year between 2001 and 2003. Nonpotable water demands are met from the reuse capability of Erie’s Windy Gap units (Harvey Economics 2006).

Projected Water Demand. The projected population forecast for Erie is based on an annual rate of growth of almost 13 percent through 2007, 6 percent through 2017, and 4 percent to buildout in 2025. Population at buildout is estimated at about 40,700 with about 14,600 housing units. Total Erie water requirements are expected to increase from about 2,500 AF in the year 2005 to 8,900 AF in the year 2025 and beyond (Figure 1-9). This represents about a 260 percent change from 2005 to 2025.

Figure 1-9 Comparison of Future Water Demands with 2004 Firm Annual Yield, Town of Erie, 2005–2050.



About 96 percent of future water demand is needed for potable uses and the remainder for nonpotable irrigation.

Water Need. Existing water supplies are currently sufficient to meet Erie’s water needs during average years of precipitation. Beginning in 2005, water demand could exceed available firm water supplies by about 360 AF. A firm water supply shortage of about 6,800 AF is estimated by buildout in 2025.

Erie has requested 6,500 AF of firm yield from NISP. This would meet about 73 percent of the Erie’s projected shortage in 2025.

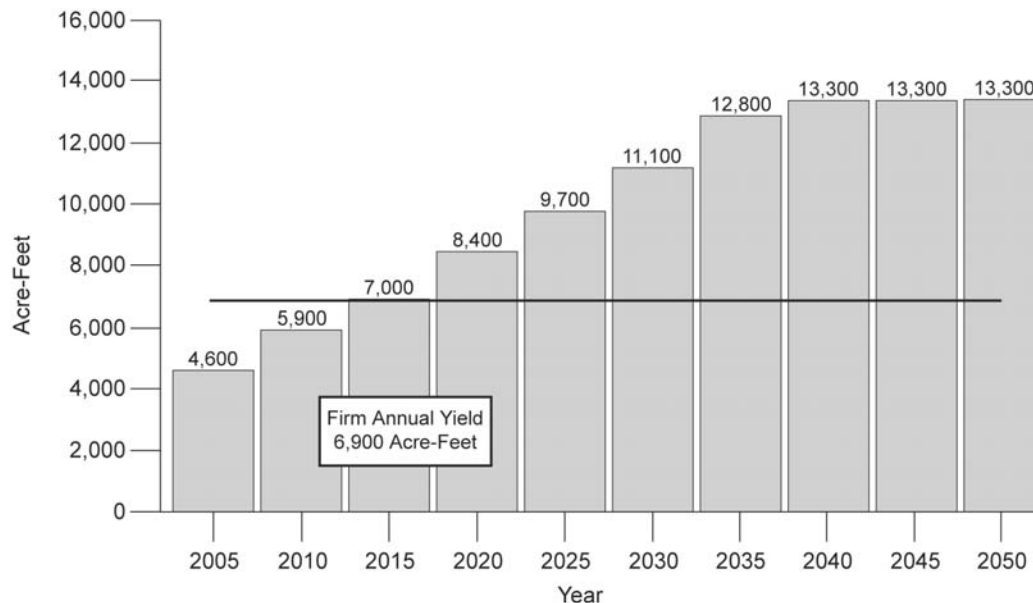
Erie also is a participant in the WGFP. Firming Erie’s Windy Gap water supply would provide up to 1,400 AF of water, or about 16 percent of Erie’s projected 2025 water supply need, not including the reuse of about 50 percent of the Windy Gap yield to meet irrigation demands. As described in Section 1.8.1, Erie would have an estimated excess of 246 AF in 2050.

1.7.4 City of Evans

The City of Evans is located in south-central Weld County just south of the City of Greeley. Evans is a highly diversified and stable community experiencing significant growth and development.

Existing Water Supply. The City of Evans currently relies on transbasin water from the C-BT Project and five local ditch companies for its potable water supply. Evans recently completed a lease/purchase for 5 units of Windy Gap water. All of Evans’ potable water is treated by the City of Greeley. Evans provides raw water to Greeley each year equal to Evans’ projected water demand, plus an additional amount (about 10 percent) to account for shrinkage losses incurred by Greeley. Evans’ nonpotable water supply includes the Evans Town Ditch, which currently exceeds the City’s nonpotable demand. In addition, Evans receives return flow credit from native water sources, which provide a variable supply of about 400 AF of reuse

Figure 1-10. Comparison of Future Water Demands with 2004 Firm Annual Yield, City of Evans, 2005–2050.



water for meeting return flow obligations. The current annual water supply available to Evans is about 9,298 AF. However, a portion of this supply, 2,367 AF, is not currently available for municipal use because the diversion point for the water is located in the Big Thompson River Basin, near the confluence with the South Platte River. To be made available for municipal use, Evans would need to construct a water treatment plant near the diversion point, and/or transfer or exchange water rights on the Evans Town Ditch. For purposes of the NISP EIS, it is assumed that water from the Evans Town Ditch is not available and therefore, Evans' firm supply is 6,932 AF.

Growth and Population Trend. Between 2000 and 2002, the City of Evans ranked among the fastest growing cities in Colorado. Over this period, Evans grew at an average annual rate of 7 percent. Between 1990 and 2004, Evans' population grew from about 5,876 to 14,860.

Current Water Demand. The City of Evans is responsible for providing water to the residential, commercial, industrial and public users located within its service area. Approximately 95 percent of Evans' customers are residential. Evans currently serves 14,860 residents within the city limits and provides water to 2,394 residents within the Arrowhead and Hill-N-Park subdivisions. Currently Evans serves no large water users. Total water requirements to meet potable and nonpotable water needs since 2000 have ranged from about 3,700 to 4,600 AF per year. During the period from 1990 to 2002, total water use (including potable and nonpotable) averaged 188 gpcd and residential water use averaged 157 gpcd.

Evans provides about 1,223 AF of nonpotable water for irrigation on rural properties, city parks, schools, open space, and two small subdivisions.

Projected Water Demand. The projected population forecast for Evans is based on an assumed annual rate of growth of 4 percent through

2010, 3 percent through 2020, and 2.5 percent thereafter. The City of Evans service area population is expected to peak at about 38,000 residents by 2037. Total raw water requirement to meet this anticipated population is about 13,300 AF per year (Figure 1-10).

Water Need. Evans' existing total firm water supply of 6,932 AF exceeds current demand during average years of precipitation (a portion of Evans' 9,298 AF water supply (2,367 AF) currently is not available for potable use). Water demand is expected to exceed available firm water supplies by about 2025, which would affect the ability of Evans to meet dry year water needs, depending on C-BT deliveries. However, the 2,367 AF of water from the Evans Town Ditch, which is included in Evans' total water supply, currently can be used only for nonpotable uses because the source of water is located outside of the Poudre Basin. As a result, the water is inaccessible to Greeley's water treatment plant, which treats water for Evans. Thus, a shortage in firm potable water supplies may occur much sooner. Based on total water supply, without accounting for source of water, a firm water supply shortage of about 6,400 AF is anticipated by 2040 when demand is expected to peak. The amount of water Evans has requested from NISP—1,600 AF of new firm yield—would meet Evans' shortage until about 2025, when it would meet about 57 percent of Evans' shortage. In 2050, the amount of firm yield Evans has requested from NISP would supply about 25 percent of Evans' projected shortage. It is possible that Evans projected shortage in 2035 and beyond could be reduced to between 4,000 AF and 6,200 AF if Evans is able to change the water right for the Evans Town Ditch, either by changing the diversion point, exchanging water with an upstream user, constructing a treatment plant, or other means.

The City of Evans also is a participant in the WGFP. Firming Evans' 5 Windy Gap units would provide

Evans with about 500 AF of water or about 4 percent of Evans' projected 2050 water supply requirement, not including the reuse of about 85 percent of the Windy Gap yield to meet return flow obligations. As described in Section 1.8.1, Evans would face a water shortage even if both NISP and the WGFP were constructed.

1.7.5 Fort Collins-Loveland Water District

The Fort Collins-Loveland Water District (FCLWD) provides water to residential, commercial, and industrial users within a 60-square-mile service area, which primarily comprises areas in and around the Cities of Fort Collins, Loveland, Windsor, and Timnath. In addition, the FCLWD delivers wholesale treated water to the Town of Windsor. The Town of Windsor is responsible for providing its own water supply; therefore, deliveries to Windsor are not included in the demands analysis for the FCLWD, but are included in the demands analysis for the Town of Windsor. The FCLWD system interconnects with the Cities of Fort Collins and Loveland, and the NWCWD and East Larimer County (ELCO). The largest user in the FCLWD service area is the Duo Dairy, which has an average demand of 125,000 gallons per day. The FCLWD is a co-owner of the Soldier Canyon Filter Plant with NWCWD and ELCO (Harvey Economics 2006).

Existing Water Supply. The FCLWD currently has a firm yield of 8,156 AF per year. A portion of the FCLWD's total deliveries, 336 AF, is owned by the Town of Windsor and is not included in the FCLWD's firm supply. The FCLWD water supply is composed of C-BT Project water, water rights in the NPIC, the Josh Ames Ditch, and the Loveland Water Bank. A portion of the FCLWD NPIC rights and all of the Loveland Water Bank rights are currently not available for municipal use, but likely

will be in the near future. The FCLWD also collectively owns about one-third of a 1998 water right on the Poudre River with the other Tri-districts (NWCWD, ELCO, and FCLWD) (HDR 2006). The FCLWD does not deliver any nonpotable water.

Growth and Population Trend. In 1991, the FCLWD service area population was 10,956 and the population grew to about 33,138 in 2004. This represents an average annual growth rate of 8.9 percent. The lowest annual growth was in 1997, when the FCLWD service area grew 5.7 percent. The highest annual growth rates were in 1992 and 1999, when growth was about 11 percent. New taps averaged 620 per year between 1991 and 2004 (Harvey Economics 2006).

Current Water Demand. Between 1992 and 2003, FCLWD potable water grew from a low of 2,692 AF in 1992 to 6,840 AF in 2002. The highest use occurred in 2000 and 2002, when total use was over 6,000 AF. In 2003, water use dropped to 5,594 AF. Of these amounts, the Duo Dairy was assumed to use about 141 AF per year. Total potable water deliveries increased by 147 percent between 1992 and 2002, at an average annual rate of 9.4 percent. Deliveries decreased by 18 percent between 2002 and 2003 because the FCLWD implemented drought restrictions. Residential users account for about 85 percent of total water deliveries. New residential taps are expected to comprise most of the growth in water demand in the FCLWD service area.

The FCLWD's total potable water, including the Duo Dairy, averaged 216 gpcd from 1992 through 2002. Potable water use per day excluding the Duo Dairy is 209 gpcd.

The FCLWD does not supply any nonpotable water; therefore, total water requirements include total deliveries plus system losses. Total water requirements from 1992 to 2003 ranged from a low of 3,145 AF in 1992 to 7,753 in 2002. The total

water requirements reflect adjustments for system losses of about 10 percent. From 1992 through 2002, total water requirements increased by 147 percent, an average annual rate of 9.4 percent, then dropped by 18 percent in 2003 (Harvey Economics 2006).

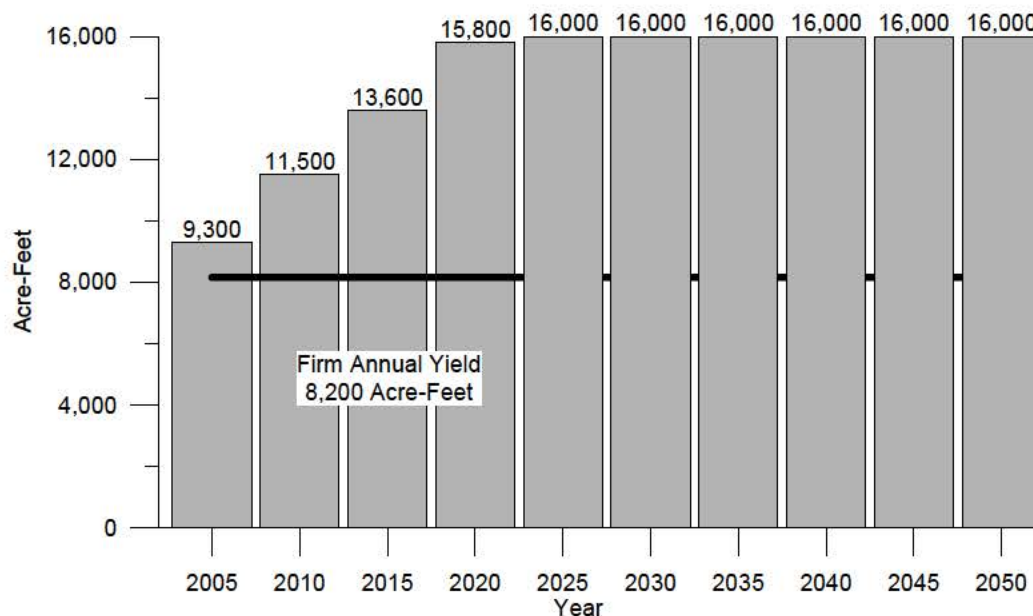
Projected Water Demand. Growth in the FCLWD service area is expected to occur at a rate of about 600 new taps per year through 2020, and 70 taps per year from 2020 to buildout, which is estimated to occur in 2025. In 2005, 12,650 taps are expected. About 22,000 taps are anticipated when the service area is expected to reach buildout in 2025 (Harvey Economics 2006) (Figure 1-11). It is assumed that the FCLWD will continue not to provide nonpotable water, and will continue to serve water to the Duo Dairy as it has in the past.

Water Need. The FCLWD currently has a firm water supply of 8,156 AF. The FCLWD faces a projected water shortage of 1,100 AF of firm supply in 2005. In 2025, the shortage is expected to be 7,800. FCLWD has requested 3,000 AF of firm yield from NISP. The FCLWD faces a firm yield shortfall, which will continue even after NISP is built. In 2025 and beyond, the amount FCLWD has requested from NISP would meet about 38 percent of the projected shortfall (Harvey Economics 2006; BBC 2005). FCLWD also is participating in the HSWMPs and has requested 3,000 AF of firm yield from Halligan and Seaman. A description of the proposed HSWMPs is provided in Section 4.28.2.1 of the EIS.

1.7.6 City of Fort Lupton

The City of Fort Lupton is located in south-central Weld County about 25 miles north of Denver. Nearby cities include Brighton, Platteville, Firestone, Frederick, and Dacono. Fort Lupton began as a trading fort in 1836; since that time, the

Figure 1-11. Comparison of Future Water Demands with 2004 Firm Annual Yield, FCLWD, 2005–2050.



community has expanded with its business, agriculture, and oil and gas-based economy.

Existing Water Supply. The City of Fort Lupton has a firm water supply of 3,538 AF. Historically, the City relied on ground water to meet its municipal water needs. With increasing growth and development along the Front Range, the quality of the ground water from Fort Lupton's wells in the South Platte River alluvium has gradually declined. For this reason, the City decided to acquire C-BT Project water in 1997 and blend this water with ground water to maintain acceptable water quality until 2005 when ground water was no longer used for drinking water. Fort Lupton recently purchased 3 units of Windy Gap water from Greeley. In addition, Fort Lupton owns shares in the Fulton Ditch, which provides water for irrigation. Fort Lupton does not currently have any sources of water available for reuse, but estimates that up to 80 percent of its Windy Gap water could be reused if the WGFP is implemented. Firm annual water

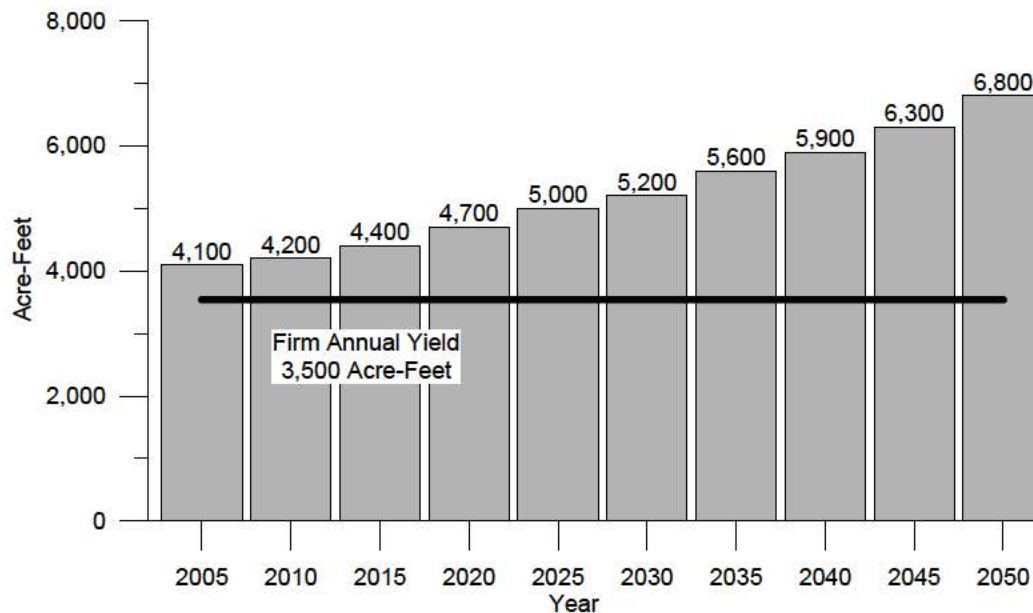
supplies currently available to Fort Lupton total 3,538 AF.

Growth and Population Trend. The City of Fort Lupton's current population is estimated at 7,071, and the City's service area is coincident with its city limits. From 1990 through 2003, population grew at an average annual rate of 2.5 percent. Total water taps increased by an average annual rate of 2.9 percent from 1997 through 2003. Annual growth rates have fluctuated since 1990, with the most significant growth occurring in 2000.

Current Water Demand. Residential use has traditionally comprised the majority of potable water demands in the City of Fort Lupton, accounting for an average of 77 percent from 1997 to 2003. From 1997 to 2003, total potable water use averaged 123 gpcd and residential water use averaged 97 gpcd.

A large portion of the remainder of Fort Lupton's water demand comes from nonpotable water needs. From 1997 through 2003, the Thermo Cogeneration power plant used, on average, 1,625 AF of water

Figure 1-12. Comparison of Future Water Demands with 2004 Firm Annual Yield, Town of Fort Lupton, 2005–2050.



annually, while other nonpotable users, including the City's parks and schools, outdoor irrigation and a golf course, used 550 AF annually on average.

Total water demand for Fort Lupton ranged from about 2,834 AF in 1997 to 3,859 AF per year in 2001. Total water use dropped to 2,954 AF in 2003. Total water requirements increased by 28 percent from 1997 through 2002, or at an average annual rate of 5.1 percent.

Projected Water Demand. Based on an annual growth rate of 2.5 percent, the City of Fort Lupton is expected to reach nearly 24,000 people by 2050. Residential, commercial, industrial, schools, city parks and irrigation water usage are all expected to track population growth. Thermo's current and future use for golf course irrigation is expected to remain steady from 2003 to 2050. Total firm annual yield water requirements of about 6,800 AF are projected by 2050 (Figure 1-12), of which about 60 percent will meet potable water demand and 40

percent will meet nonpotable water needs, including the Thermo Cogeneration facility.

Water Need. Beginning in 2005, water demand will exceed available firm water supplies during dry years, depending on C-BT deliveries, by about 560 AF. By 2025, Fort Lupton's firm water demand is projected to exceed supply by about 1,500 AF; by 2050 about 3,300 AF of additional water will be needed to meet Fort Lupton's water needs. Fort Lupton has requested 3,000 AF of new firm yield from NISP annually. The amount Fort Lupton has requested from NISP would meet Fort Lupton's water shortage until 2050, when it would supply about 91 percent of the projected shortage.

Fort Lupton also is a participant in the WGFP. Firming Fort Lupton's three units of Windy Gap water will provide Fort Lupton with about 300 AF of water, or about 5 percent of its projected 2050 water need, not including reuse of up to 80 percent of Windy Gap water. As described in Section 1.8.1,

the City of Fort Lupton would face a water shortage even if both NISP and the WGFP were constructed.

1.7.7 City of Fort Morgan

The City of Fort Morgan is located in an agricultural area on the South Platte River about 45 miles east of Greeley. The City of Fort Morgan is responsible for providing water to residential, commercial, industrial, and irrigation users within the City's boundaries plus about 12 taps outside of the City's boundaries. Until 2006, the Morgan County Quality Water District (MCQWD) supplied water to Leprino Foods, a large commercial user; in 2006, Fort Morgan resumed service to Leprino Foods. Fort Morgan also serves Excel Beef, another large commercial user.

Existing Water Supply. Fort Morgan's current firm water supply is 4,481 AF per year. The City of Fort Morgan relies solely on C-BT units for its potable water supply. In the past, Fort Morgan has supplied its water needs using ground water; however, because of water quality issues related to nitrates levels, radionuclides, and extremely high water hardness, Fort Morgan switched completely to C-BT water supplies in 1999 (Harvey Economics 2006). Within the city limits, the City operates 14 wells historically used to supply the municipality; however, today the wells irrigate 175 acres of open space. Fort Morgan owns mutual company shares in Fort Morgan Reservoir and Irrigation Company, Pioneer Ditch Company, and conveyance rights in the Platte Avenue Lateral Company and the South Side Lateral Company. These shares are used to irrigate the parks, cemetery and an 18-hole golf course. They also are used to augment the City's wells. Fort Morgan leases C-BT units from Riverside Irrigation Company and MCQWD (HDR 2006).

Growth and Population Trend. The City of Fort Morgan grew from a population of 9,068 in 1990 to 10,994 in 2003, an increase of 21 percent or an average annual rate of 1.5 percent. Annual growth rates have fluctuated from a loss of almost 1 percent in 1998 to an 8.7 percent gain in 2000.

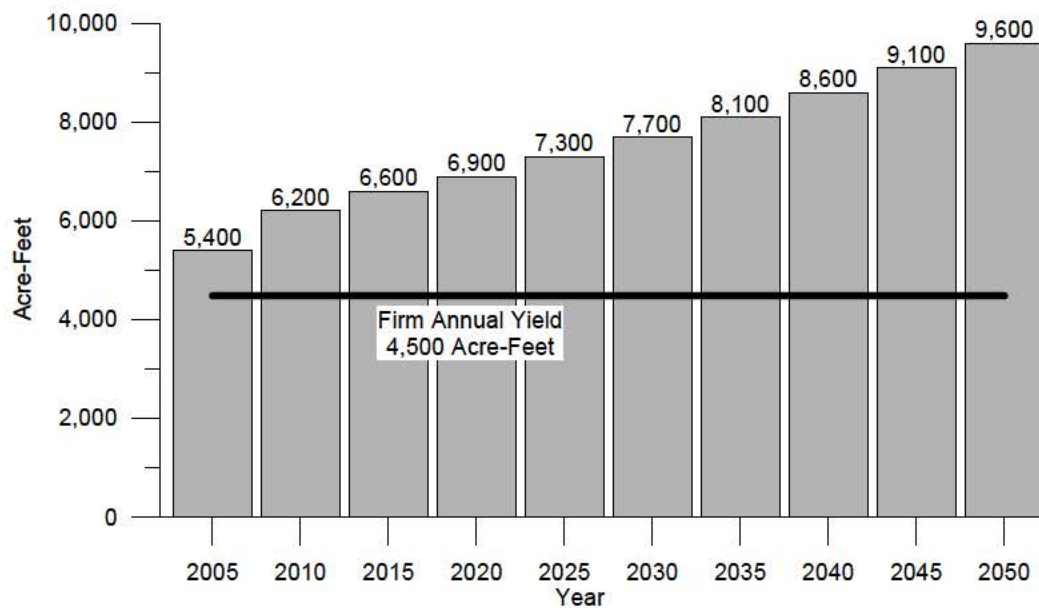
The City of Fort Morgan's estimated 2005 population is about 11,400. An annual growth rate of 1.7 percent is expected over the next 45 years. In 2025, it is expected that the population of the Fort Morgan service area will be 15,900, and in 2050, the population is expected to be 24,300.

Current Water Demand. Residential users historically have accounted for about 42 percent of the total potable water deliveries to the City of Fort Morgan. Excel Beef is the largest user of water in Fort Morgan, with deliveries ranging from 1,363 AF per year in 2003 to 1,765 AF per year in 1996. Fort Morgan's potable water demand does not follow a clear trend, and has ranged from 2,619 AF in 2003 to 4,280 AF in 2000. The drop in deliveries in 2003 probably is related to drought restrictions, and because some of Excel Beef's potable supply was shifted to nonpotable water.

Total potable demands rose 11 percent from 1995 to 2000. A notable increase in potable water deliveries occurred between 1999 and 2000, when Fort Morgan switched from ground water to C-BT water. Average annual growth in potable water demands from 1995 through 2002 was 1.5 percent, which is similar to the population growth rate in Fort Morgan over a similar period of time (Harvey Economics 2006).

From 1995 through 2002, total water use per capita has averaged 326 gpcd; without Excel Beef's use, per capita use averaged 188 gpcd. No trends in per capita use were apparent (Harvey Economics 2006). Until 2001, Fort Morgan provided only potable water to its customers—including irrigation and

Figure 1-13. Comparison of Future Water Demands with 2004 Firm Annual Yield, City of Fort Morgan, 2005–2050.



Excel Beef. In 2001, Fort Morgan switched its outdoor irrigation to nonpotable ground water and began to serve some of Excel Beef’s water demands with nonpotable ground water. These practices will continue in the future.

The total water requirements, including potable and nonpotable deliveries, ranged from 3,284 in 1999 to 4,688 in 2002. From 1995 to 2002, peak water requirements increased by 21 percent, at an average annual rate of 2.8 percent (Harvey Economics 2006).

Projected Water Demand. Fort Morgan’s total firm water requirement is expected to be 5,400 AF in 2005, about 7,300 AF in 2025, and 9,600 AF in 2050 (Figure 1-13).

Water Need. The City of Fort Morgan currently faces a shortage of about 900 AF of firm yield. Fort Morgan is expected to have a 2,800 AF shortage in 2025, and a 5,100 AF shortage of firm supply in 2050.

Fort Morgan has requested 3,600 AF of firm yield from NISP. The new firm yield requested from

NISP would provide over 100 percent of the shortage until 2035. In 2050, the water requested from NISP would meet 71 percent of the projected shortage (Harvey Economics 2006; BBC 2005).

1.7.8 City of Lafayette

The City of Lafayette is located just east of the City of Boulder on the eastern edge of Boulder County. Bordering communities include the cities of Louisville and Broomfield, and the towns of Superior and Erie. Similar to many communities along the rapidly growing U.S. Highway 36 corridor, the City of Lafayette experienced significant growth in population over the last decade.

Existing Water Supply. The City of Lafayette’s raw water supply is based primarily on shared ownership in several ditch and reservoir companies with diversions from Boulder Creek and South Boulder Creek. Lafayette’s ownership in three reservoirs also provides storage capacity prior to water treatment and delivery. In addition, Lafayette

recently joined the District and has acquired C-BT units. Lafayette is in the process of acquiring eight units of Windy Gap water. The City is evaluating implementation of a reuse program for landscape irrigation and currently exchanges effluent for diversions from South Boulder Creek. Reuse of existing native water provides an average yield of about 200 AF. Lafayette plans to fully utilize all available effluent associated with Windy Gap water if firmed, which, accounting for consumptive use and losses, typically is about 80 percent depending on season of use and the reclaimed water system. The estimated firm annual water supply for the City of Lafayette is currently 4,534 AF not counting reuse water.

Growth and Population Trend. Lafayette's current service area population is estimated at about 25,500. From 1979 to 2002, the City's population grew at an average annual rate of 4.6 percent. Annual growth rates for both population and the number of residential units have fluctuated. Significant growth, ranging from 8 to 10 percent per year, occurred during the early 1980s and mid 1990s, followed by periods of slower growth. In 1995, Lafayette imposed growth restrictions that limited the number of new residential dwelling permits. These restrictions were modified in 2000 to allow for an additional 50 affordable, permanently deed-restricted units per year.

Lafayette is responsible for providing water to residential, commercial, industrial, and irrigation users within the City's boundaries. In addition, the City also provides water to the East Boulder County and Baseline Water Districts to serve certain rural residential customers. As of 2004, Lafayette did not serve any large water users.

Potable water demands have ranged from about 2,622 AF in 1994 to about 3,945 AF in 2001, dropping to 3,478 AF in 2003. Residential users

account for the majority of potable deliveries. Total potable water deliveries increased by 33 percent between 1994 and 2003, or at an average annual rate of 4.5 percent, and decreased by about 30 percent during 2002 and 2003.

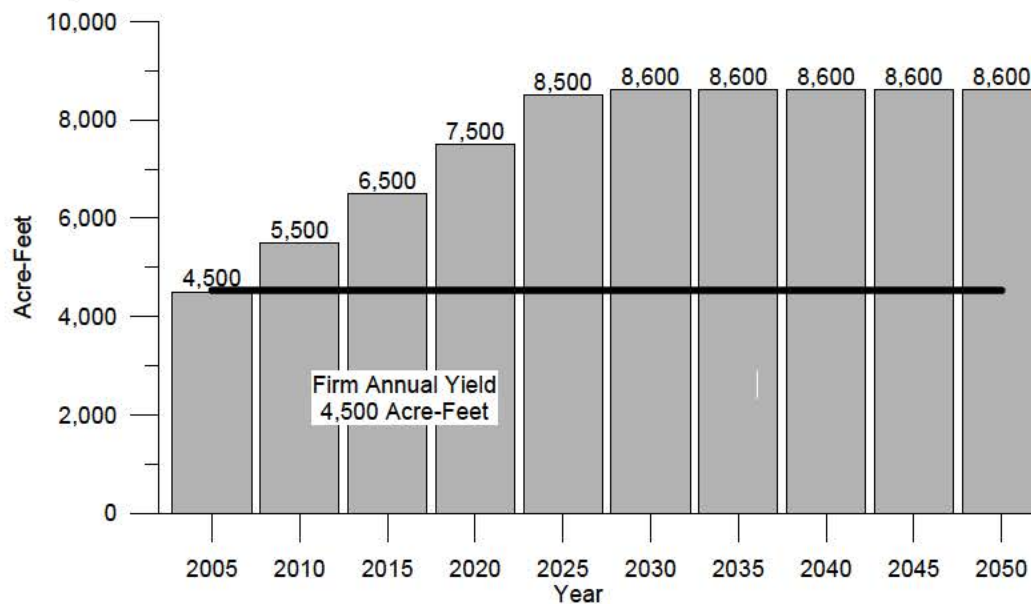
Lafayette supplies about 325 AF of nonpotable water to irrigate the City's golf course and landscaping along U.S. 287. The golf course receives about 300 AF per year and about 25 AF of water are used to irrigate along U.S. 287 each year.

Current total water demands of 4,079 AF per year serve a population within the City of 24,637 people and an additional 359 residential taps outside the City's limits. Total water use has averaged 134 gpcd and residential water use has averaged 108 gpcd for 1993 to 2003.

Projected Water Demand. Projected future growth rates of less than 2 percent lead to a buildout population estimate of about 36,000 in 2026. Future water demand projections are estimated at a rate consistent with population growth. Total raw water requirements by 2026 are estimated to be 8,600 AF (Figure 1-14), of which about 87 percent meets potable water demand and the remainder is used to meet nonpotable use requirements.

Water Need. Existing water supplies are currently sufficient to meet Lafayette's water needs during average years of precipitation. Beginning in 2010, Lafayette faces a shortage of about 1,000 AF of firm yield. By buildout in about 2026, Lafayette's water demand is expected to exceed firm water supply by about 4,100 AF. Lafayette has requested 1,800 AF of new firm yield from NISP. The amount Lafayette has requested from NISP would meet projected shortages until about 2015, when it would meet about 90 percent. At buildout (2026 and beyond), the amount Lafayette has requested from NISP would meet about 44 percent of the projected water shortage.

Figure 1-14. Comparison of Future Water Demands with 2004 Firm Annual Yield, City of Lafayette, 2005–2050.



Lafayette also is a participant in the WGFP. Firming 8 units of Lafayette’s Windy Gap water would provide a firm annual yield of about 800 AF, of which about 80 percent could be reused for nonpotable irrigation requirements. A firm Windy Gap water supply would provide Lafayette about 9 percent of Lafayette’s projected water supply requirement, not counting the reuse potential. As described in Section 1.8.1, Lafayette would face a water shortage even if both NISP and the WGFP were constructed.

1.7.9 Lefthand Water District

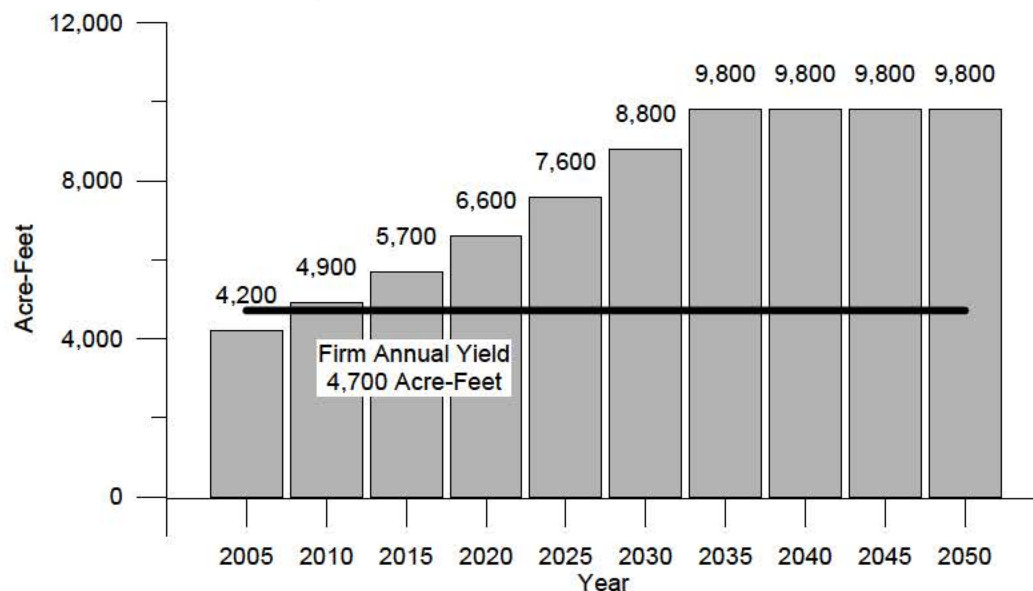
The Lefthand Water District (LHWD) serves an approximate 135-square-mile service area in Boulder and Weld counties. The approximate boundaries of the service area are the foothills to the west, Erie and Boulder to the south, Longmont to the North, and I-25 to the east (Harvey Economics 2006). The LHWD was founded in 1960 to serve

rural residences, and currently serves residential, commercial, and industrial users.

Existing Water Supply. The LHWD’s current firm water supply is 4,712 AF per year. Lefthand Water District has three sources of water: Left Hand Ditch Company shares, C-BT units, and Windy Gap units. LHWD has approximately 1,000 AF of storage available for use in any of the Left Hand Ditch Company’s reservoirs (HDR 2007a).

Growth and Population Trend. The LHWD grew from a population of 10,736 in 1990 to about 18,158 in 2003, an average annual rate of 4 percent. Annual growth rates were highest in 1993, 1994, and 1999, when the average annual growth rate ranged from 8 percent to 9.8 percent. Since 2003, a large amount of growth has occurred in newly annexed parts of the Town of Frederick (Harvey Economics 2006). The LHWD serves the portion of Frederick west of I-25 and the CWCWD deliver water to the portion of the town of Frederick east of I-25.

Figure 1-15. Comparison of Future Water Demands with 2004 Firm Annual Yield, Lefthand Water District, 2005–2050.



Current Water Demand. Total potable water deliveries increased from 3,346 AF in 1990 to about 3,991 AF in 2000 and 2001. Deliveries declined in 2002 and 2003 to about 3,377 AF because of the drought. Between 1990 and 2003, total potable water deliveries increased by 1.2 percent. Between 1990 and 2001, however, total potable water deliveries increased by about 20 percent.

The LHWD owns a total of 2,854 shares of the Left Hand Ditch Company stock, but 1,038 of those shares, with an average annual yield of 1,245 AF per year, cannot be used for potable demands because of bylaw restrictions on the area of use. LHWD uses a portion of these shares for irrigation of its rural properties, and the remaining portion is used as supplemental irrigation water for agricultural users in the LHWD's system (Harvey Economics 2006).

Total per capita per day water use ranged from 167 gpcd in 2003 to 278 gpcd in 1990. The average total per capita per day use from 1990 to 2003 was 189 gpcd (Harvey Economics 2006). Total water

requirements ranged from about 3,100 AF per year in 1992 and 1993 to about 4,800 AF in 2000 and 2001. Total water requirements increased from 3,983 AF in 1990 to 4,853 AF in 2000, a gain of 870 AF or about 22 percent.

Projected Water Demand. The number of taps in the LHWD is expected to increase from about 6,700 residential tap equivalents (RTE) in 2005 to about 12,100 in 2025 and about 15,500 in 2035, when the LHWD is expected to reach buildout. The total water demand in the LHWD is expected to increase at an average annual rate of about 2.9 percent until 2035.

Water Need. The LHWD currently has sufficient firm yield to meet its total water requirements during average years. By 2010, the LHWD is projected to face a water shortage of about 190 AF of firm supply. In 2025, it is projected that the LHWD will face a water shortage of about 4,000 AF, and in 2050 (Figure 1-15), it is projected that the LHWD will

face a water shortage of about 5,100 AF of firm supply.

The LHWD has requested 4,900 AF of new firm yield from NISP. This would supply more than 100 percent of the LHWD's projected water shortage until almost 2035, when it would supply 96 percent of the projected water shortage. From 2035 and beyond, the amount the LHWD has requested from NISP would supply 96 percent of its projected shortfall.

1.7.10 Morgan County Quality Water District

The Morgan County Quality Water District (MCQWD) serves residential, commercial, and industrial users within its boundaries in Morgan County, excluding the town of Fort Morgan. In addition, the MCQWD temporarily serves water to Leprino Foods, located in the City of Fort Morgan, and to several large dairies. Leprino Foods and the dairies are MCQWD's largest water users, and since 2006, Leprino Foods has been served by Fort Morgan. The demand projections included for the MCQWD do not include Leprino Foods. Instead, Leprino Foods' demands are included in demand projections for Fort Morgan. A portion of the MCQWD's service area is located outside of the District service area, and any water demands outside of the District service area cannot be served by water from NISP and have not been included in the water demands study for NISP (Harvey Economics 2006).

Existing Water Supply. The MCQWD's current firm water supply is 2,512 AF per year. The MCQWD water supply consists of seven ground water wells and C-BT Project water.

Growth and Population Trend. The number of taps in the MCQWD service area has increased from about 1,065 taps in 1990 to about 2,047 taps in 2003.

The number of taps has grown at an annual rate of 5.2 percent between 1990 and 2003, or about 76 taps per year, but the average annual growth rate has ranged from 2.5 to almost 9 percent (Harvey Economics 2006). In 2002 and 2003, growth has increased, and there were 117 new taps in 2002 and 166 new taps in 2003.

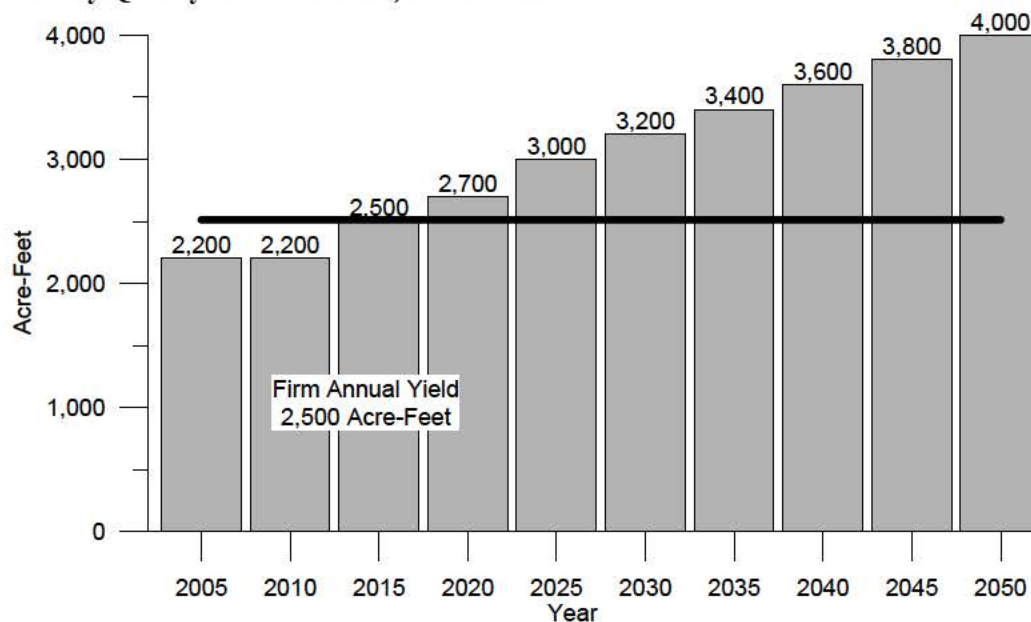
Current Water Demand. Total potable use increased from 832 AF in 1990 to 1,845 AF in 2002, decreasing to 1,661 AF in 2003 due to the drought. Total potable water demands more than doubled from 1990 to 2002. Total potable deliveries increased at an average annual rate of 6.9 percent between 1990 and 2002 (Harvey Economics 2006).

Excluding Leprino Foods and the large dairies, total potable water use ranged from 193 gpcd to 232 gpcd between 1990 and 2003. Total potable water use, including Leprino Foods and the large dairies ranged from 235 gpcd in 1993 to 325 gpcd in 1998. The average per capita use between 1990 and 2002 was 296 gpcd.

The MCQWD does not provide any nonpotable water to its customers; total water requirements include potable uses and system losses. Total water requirements for the MCQWD increased from 837 AF in 1990 to about 1,900 AF in 2000 and 2002, before falling to 1,661 AF in 2003. From 1990 to 2002, total water requirements increased by 126 percent, or at an average annual rate of about 7 percent (Harvey Economics 2006).

Projected Water Demand. The total number of taps was estimated to increase from about 2,200 in 2005 to about 3,800 in 2025 and 5,400 in 2050. Total water requirements are expected to increase from about 1,631 AF in 2003 to 3,000 AF in 2025, and 4,000 AF in 2050 (Figure 1-16). This represents an increase of about 82 percent, or an average annual rate of about 1.3 percent (Harvey Economics 2006).

Figure 1-16. Comparison of Future Water Demands with 2004 Firm Annual Yield, Morgan County Quality Water District, 2005–2050.



Water Need. The MCQWD currently has sufficient water supplies to meet its total water requirements during average years. In 2020, the MCQWD is projected to face a 190 AF shortage of firm water supply. It is projected that in 2025, the MCQWD will face a 490 AF water shortage, and in 2050, the MCQWD will face a 1,500 AF shortage of firm water supply.

The MCQWD has requested 1,300 AF of firm yield from NISP. The amount the MCQWD has requested from NISP would fulfill the projected shortfall until 2040. In 2050, the amount the MCQWD has requested from NISP would provide about 87 percent of the projected water shortage.

1.7.11 Town of Severance

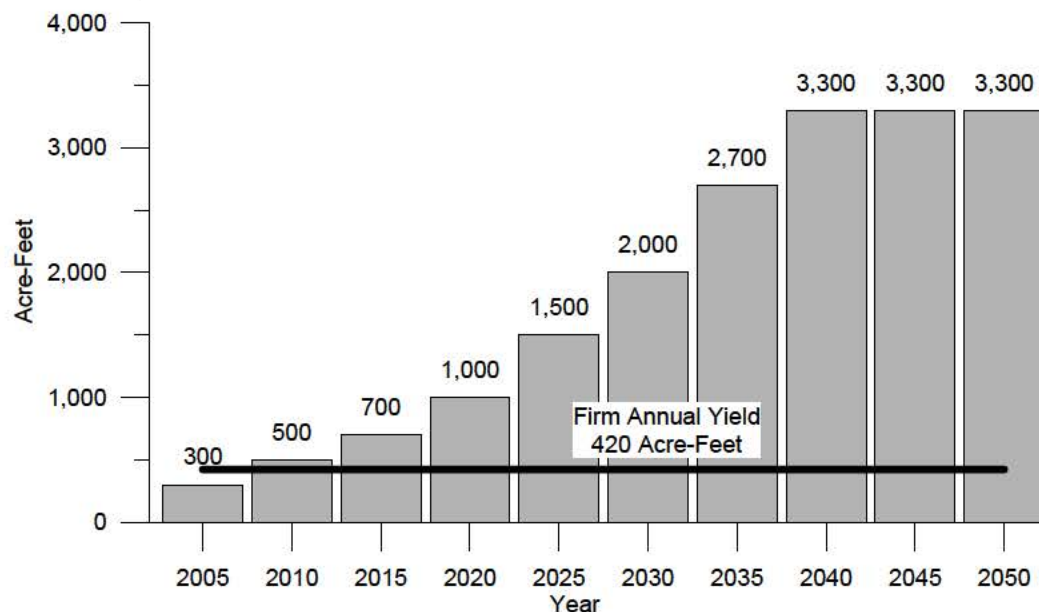
The Town of Severance is located on the plains east of Fort Collins and I-25. The Severance water service area boundaries are not the same as the town boundaries. The NWCWD serves some areas within the Town, and Severance serves some areas outside

the Town boundaries. Until 2003, the NWCWD was responsible for meeting water demands for Severance. Since that time, however, Severance has been responsible for obtaining its own raw water supplies, but the NWCWD delivers the water to Severance.

Existing Water Supply. Severance's current firm water supply is 422 AF per year. Severance's water supply consists of C-BT Project water, NPIC units, some of which are C-BT Project water and some of which are native flows and not currently available for municipal use. NPIC native flows are not included in the total water supply for NISP because they are not available for municipal use. Severance also has a carrying right in the Finley lateral, but no consumptive water rights from this source.

Growth and Population Trend. The population in Severance's service area has grown from about 129 in 1990 to about 1,300 in 2003, an average annual rate of approximately 20 percent. Prior to 1996, the annual growth rate was less than 2 percent; since

Figure 1-17. Comparison of Future Water Demands with 2004 Firm Annual Yield, Town of Severance, 2005–2050.



1996, however, the annual growth rate has generally ranged between 25 and 50 percent. The population of Severance grew by fivefold between 1996 and 2003 (Harvey Economics 2006).

Current Water Demand. Potable water deliveries to the town of Severance increased from about 28 AF in 1995 to 163 AF in 2004. Total water deliveries increased at an average annual rate of 21 percent, or by 135 AF between 1995 and 2004 (Harvey Economics 2006).

Total water use per capita per day ranged from 88 gpcd in 2002 and 2003 to about 180 gpcd in 1996 and 2000. Total potable per capita water use averaged 165 gpcd between 1995 and 2001.

Severance irrigates about 7 acres of parks with nonpotable water. Total nonpotable water requirements are about 14 AF per year.

The total water requirements for the Town of Severance service area increased from 79 AF in 1995 to 233 AF in 2004.

Projected Water Demand. An annual growth rate of 8 percent is predicted until 2025; after 2025, the annual growth rate is expected to drop to 6 percent. The expected buildout population in Severance's service area is 15,000, which is expected to occur between 2040 and 2045. In 2005, the population was about 1,500, in 2025, the population is expected to be 6,700, and in 2050, the population is expected to be 15,000.

The estimated firm annual water requirement in 2005 was 300 AF, which would increase to 1,500 AF in 2025, and 3,300 AF in 2040 and beyond (Harvey Economics 2006) (Figure 1-17).

Water Need. Severance faces 80 AF shortage of firm water supply beginning in about 2010. In 2025, Severance will face a shortage of about 1,100 AF of firm supply. In 2050, Severance will face a water shortage of about 2,900 AF of firm water supply.

Severance has requested 1,300 AF of new firm yield from NISP. This would provide over 100 percent of Severance's projected water shortage until about

2030, when it would provide about 81 percent of the projected water shortage. The amount Severance has requested from NISP would provide about 45 percent of Severance's projected shortage of firm water supply in 2040 and beyond (BBC 2005).

1.7.12 Town of Windsor

The Town of Windsor was founded in 1882 as an agricultural center, and much of the Town's early growth was attributable to sugar beet production, which ended in the mid-1960s. In the 1970s, Kodak located a facility near Windsor, which triggered rapid growth. Windsor has experienced further growth since 1990, as development has occurred along the I-25 corridor (Harvey Economics 2006).

Existing Water Supply. Windsor's current firm water supply is 2,492 AF per year. Windsor's water supply consists of C-BT units and NPIC shares. Some of the NPIC shares are not currently available for municipal use. The native part of the NPIC shares are designated for agricultural use and are rented to agricultural water users. Windsor also uses wells for irrigating parks and schools.

Windsor only accepts C-BT units or NPIC shares. On a limited basis, Windsor will accept cash-in-lieu to fund the purchase of raw water rights (HDR 2006).

Growth and Population Trend. The population of the Town of Windsor has grown from 5,062 in 1990 to 15,200 in 2004. This represents a population growth of 200 percent and an average annual population growth rate of 8 percent. The total number of water taps served by the Town of Windsor doubled from 1990 to 1999, and in 2004 there were about 4,110 water taps in the Town of Windsor. About 95 percent of the water taps are for residential users.

Current Water Demand. Total potable water demand has ranged from 324 AF in 1990 to 665 AF in 2002, before dropping to 579 AF in 2003. Water deliveries doubled between 1990 and 2002. Residential water use accounts for almost 75 percent of Windsor's total water use. Industrial use accounts for more than 9 percent of Windsor's total water use. The three largest industrial water users are Metal Container, Owens-Illinois, and a bottling plant. Metal Container's water use rate is expected to remain steady, but the bottling plant and Owens-Illinois water use is expected to rise in the future.

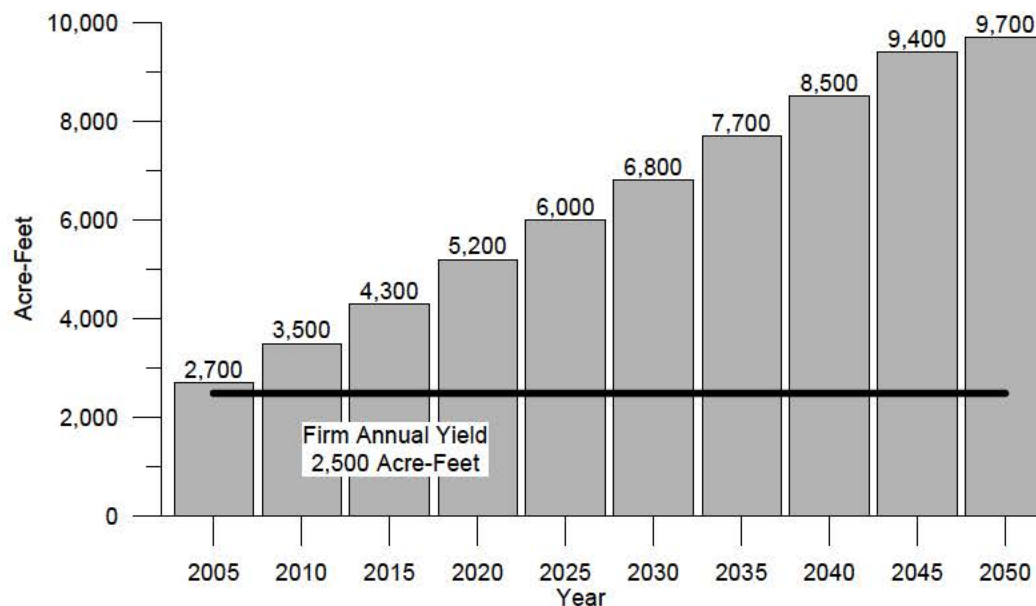
Total per capita per day water use has ranged from 102 gpcd in 2003 when water use was low due to the drought, to 170 gpcd in 1991. Average per capita water use was 146 gpcd from 1990 to 2003.

Nonpotable water use is common in the Town of Windsor, and the Town requires dual water systems for new developments. Dual water customers are responsible for providing nonpotable water for irrigation through lake and ditch systems (Harvey Economics 2006). Nonpotable demands are not included in projected water demands because under Windsor's dual use system, users are responsible for providing their own water.

Total water requirements for the Town of Windsor ranged from about 1,100 AF in 1990, 1992, and 1993 to about 2,300 AF in 2002 and 2003. Total water deliveries increased by 105 percent between 1990 and 2002. Average annual growth in the Town of Windsor's water requirements was 4.6 percent (Harvey Economics 2006).

Projected Water Demand. The population of the Town of Windsor is expected to increase from 16,200 in 2005 to 36,900 in 2025, and 60,000 in 2050. It is projected that about 375 new RTEs per year will be added in the Town of Windsor until 2050 or until buildout, which is 21,470 homes. Annual growth is expected to be about 7 percent in

Figure 1-18. Comparison of Future Water Demands with 2004 Firm Annual Yields, Town of Windsor, 2005–2050.



the near future, but is expected to drop to less than 2 percent as Windsor reaches buildout in 2047.

In 2005, the Town of Windsor's total water requirements were estimated to be 2,700 AF, including potable demands and system losses. In 2025, Windsor's total water requirement is expected to be 6,000 AF, and in 2050, Windsor's total water requirement is expected to be 9,700 AF (Figure 1-18). These estimates do not include nonpotable water demands (Harvey Economics 2006).

Water Need. The Town of Windsor faces an immediate shortage of about 210 AF, a shortage of about 1,000 AF of firm yield by 2010, a shortage of about 3,500 in 2025, and a shortage in firm water supply of about 7,200 in 2050. The Town of Windsor has requested 3,300 AF of new firm yield from NISP. This amount would cover over 100 percent of projected water shortages until almost 2025, when it would cover about 94 percent of the projected water shortage. In 2050, the amount of firm annual yield Windsor has requested from NISP would provide about 46 percent of the projected water supply shortage.

1.8 RELIANCE ON NISP TO MEET FUTURE DEMAND

Table 1-10 summarizes the NISP Participants' projected shortage. Six of the Participants face an immediate shortage of new firm yield. For five of the NISP Participants (Erie, Evans, FCLWD, Lafayette, and Windsor), the projected shortages of firm yield would exceed the amounts requested by NISP by 2024. Table 1-11 lists the percentage of the Participants' water shortage that would be supplied by the new firm yield requested from NISP. Table 1-11 includes a 10 percent safety factor to account for uncertainty in future projected demands (see Section 1.6.1). Although the proposed Project likely would not be online until 2017, the FCLWD and the City of Lafayette face water shortages exceeding the amount they have requested from NISP before 2010 and 2015, respectively (Table 1-11). For three of the Participants (Erie, Evans, and Windsor), the new firm yield each has requested from NISP would supply projected water shortages until between 2015 and 2020. By 2025, Severance's projected water needs would have exceeded the amount supplied by NISP. By 2040, all of the Participants projected firm yield water shortages would have exceeded the amounts they have requested from NISP.

1.8.1 Relationship to Other Water Supply Projects

Other water supply projects are proposed for northeastern Colorado. Some of the NISP Participants also may pursue separate water supply projects individually or participate with other water suppliers in joint water supply projects. The Participants also would independently continue to pursue conversion of C-BT and non-C-BT agricultural water rights to municipal uses, and likely would pursue independent smaller storage and

conveyance facilities. As previously described, NISP will supply a portion of the Participants' future water supply needs, but will not fully meet the Participants' estimated future water supply needs. Because all of the Participants face water shortages that would only partly be met by the new firm yield they have requested from NISP, it is likely that all of the Participants would pursue additional water sources no matter if NISP is implemented.

The Municipal Subdistrict of the Northern Colorado Water Conservancy District (Subdistrict), on behalf of several of the Windy Gap Project unitholders or allottees and the Middle Park Water Conservancy District, is currently pursuing the WGFP. Some of the NISP Participants are also participating in the proposed WGFP (CWCWD, Town of Erie, City of Evans, City of Fort Lupton, and the City of Lafayette). NISP and the WGFP are separate projects with independent utility. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area (67 Fed. Reg. 2094 (January 15, 2002)).

NISP is proposed to be constructed regardless of the final disposition of the proposed WGFP. NISP and the proposed WGFP are very different projects. The two proposed projects differ in water source, yield, timing, and location. The only similarities between the two projects are coordination by the District (or Subdistrict, in the case of the WGFP), the five common participants previously listed, and the District's Proposed Action use of C-BT facilities to convey non C-BT water. NISP is a new proposed regional water supply project that will rely on water rights in the Cache la Poudre and South Platte Rivers. The WGFP is designed to deliver a firm yield from the existing Windy Gap Project and its adjudicated water rights on the Colorado River.

Table 1-10. Projected Shortages in Firm Yield (AF).

Participant	Firm Yield ¹	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	Year of Projected Shortage
CWCWD	8,465	2,000	-840	-3,200	-5,300	-7,100	-8,700	-10,400	-11,700	-12,900	-14,120	2010
Eaton	1,616	180	-30	-230	-430	-630	-830	-1,000	-1,200	-1,400	-1,600	2010
Erie	2,145	-360	-2,300	-3,800	-5,300	-6,800	-6,800	-6,800	-6,800	-6,800	-6,800	2005
Evans ²	6,932	2,300	1,000	-100	-1,500	-2,800	-4,200	-5,900	-6,400	-6,400	-6,400	2015
FCLWD	8,156	-1,100	-3,300	-5,400	-7,600	-7,800	-7,800	-7,800	-7,800	-7,800	-7,800	2005
Fort Lupton	3,538	-560	-660	-860	-1,160	-1,500	-1,700	-2,100	-2,400	-2,800	-3,300	2005
Fort Morgan	4,481	-900	-1,700	-2,100	-2,400	-2,800	-3,200	-3,600	-4,100	-4,600	-5,100	2005
Lafayette	4,534	30	-1,000	-2,000	-3,000	-4,000	-4,100	-4,100	-4,100	-4,100	-4,100	2010
LHWD	4,712	510	-190	-990	-1,900	-2,900	-4,100	-5,100	-5,100	-5,100	-5,100	2010
MCQWD	2,512	310	310	10	-190	-490	-690	-900	-1,100	-1,300	-1,500	2020
Severance	422	120	-80	-280	-580	-1,100	-1,600	-2,300	-2,900	-2,900	-2,900	2010
Windsor	2,492	-210	-1,000	-1,800	-2,700	-3,500	-4,300	-5,200	-6,000	-6,900	-7,200	2005
Total	50,005	2,320	-9,790	-20,750	-32,060	-40,420	-48,020	-55,200	-59,600	-63,000	-65,920	2010

¹Does not include a 10 percent safety factor for demand projections.

²It is possible that Evans projected shortage in 2035 and beyond could range from 4,000 AF to 6,200 AF if Evans is able to change the water right for the Evans Ditch, either by changing the diversion point, exchanging water with an upstream user, constructing a treatment plant, or other means.

Table 1-11. NISP Contribution to Meeting Firm Yield Need.

Participant	Current Firm Yield	NISP Firm Yield	2025 Demand	2025 Demand with 10% Safety Factor	2025 Firm Yield Deficit ¹	2025 Firm Yield Deficit with NISP ¹	Percent of 2025 Firm Yield Deficit ¹ Met by NISP	2050 Demand	2050 Demand with 10% Safety Factor	2050 Firm Yield Deficit ¹	2050 Firm Yield Deficit with NISP ¹	Percent of 2050 Firm Yield Deficit ¹ Met by NISP
	AF						%	AF				%
CWCWD	8,465	8,400	15,600	17,160	-8,700	-300	97	22,600	24,860	-16,400	-8,000	51
Eaton	1,616	1,300	1,600	1,760	-100	1,200	1300	2,600	2,860	-1,200	100	108
Erie	2,145	6,500	8,900	9,790	-7,600	-1,100	86	8,900	9,790	-7,600	-1,100	86
Evans	6,932	1,600	9,700	10,670	-3,700	-2,100	43	13,300	14,630	-7,700	-6,100	21
FCLWD	8,156	3,000	16,000	17,600	-9,400	-6,400	32	16,000	17,600	-9,400	-6,400	32
Ft. Lupton	3,538	3,000	5,000	5,500	-2,000	1,000	150	6,800	7,480	-3,900	-900	77
Ft. Morgan	4,481	3,600	7,300	8,030	-3,500	100	103	9,600	10,560	-6,100	-2,500	59
Lafayette	4,534	1,800	8,500	9,350	-4,800	-3,000	38	8,600	9,460	-4,900	-3,100	37
LHWD	4,712	4,900	7,600	8,360	-3,600	1,300	136	9,800	10,780	-6,100	-1,200	80
MCQWD	2,512	1,300	3,000	3,300	-800	500	163	4,000	4,400	-1,900	-600	68
Severance	422	1,300	1,500	1,650	-1,200	100	108	3,300	3,630	-3,200	-1,900	41
Windsor	2,492	3,300	6,000	6,600	-4,100	-800	80	9,700	10,670	-8,200	-4,900	40
Total	50,005	40,000	90,700	99,770	-49,500	-9,500	81	115,200	126,720	-76,600	-36,600	52

¹Includes 10 percent safety factor.

The existing water supplies and future demands for the five common participants in NISP and the WGFP were estimated in the same manner for each of the proposed projects. The existing firm yield from the Windy Gap Project is zero. If the WGFP is built as proposed, it would provide a firm water supply to the five common participants of about 2,400 AF depending on Participant storage requests and the alternatives under evaluation. This additional future firm water supply would not be enough to replace or reduce the combined respective requested firm annual supply from NISP (Table 1-12). Although Erie's requests from NISP and the WGFP exceed Erie's projected 2050 shortage by 246 AF, there are some uncertainties with regard to future demands.

The FCLWD also is a participant in the proposed HSWMPs. The HSWMPs and NISP are separate projects with independent utility. A description of the proposed HSWMPs is provided in Section 4.28.2.1. FCLWD has requested 3,000 AF of firm yield in the proposed HSWMPs for drought protection. At this time, it is not clear to what

degree the requested storage will meet the future water demands of FCLWD. Including the firm yield requested from NISP, FCLWD will still have a projected firm yield deficit of 4,800 AF in 2050 (Table 1-11). Assuming a conservative storage-to-yield ratio of 2 to 1, the requested storage in the proposed HSWMPs would not meet the projected 2050 firm yield deficit for FCLWD.

NISP also could be physically linked to other existing facilities such as Horsetooth Reservoir or the Pleasant Valley pipeline, which could be used to convey NISP water. These existing facilities have utility independent of NISP and as described in Chapter 2, NISP could operate without connections to these facilities.

1.9 SCOPING ISSUES TO BE ADDRESSED IN THIS DRAFT EIS

Public scoping outreach activities included publication of a Notice of Intent (NOI) in the Federal Register on August 20, 2004, paid

Table 1-12. Potential WGFP Firm Yield.

Participant	WGFP Firm Yield (AF) ¹	NISP Firm Yield (AF)	2050 Projected Shortage (AF) ²	2050 Shortage if WGFP and NISP Constructed
CWCWD	100	8,400	-16,400	-8,000
Erie ³	1,400	6,500	-7,645	246
Evans ⁴	500	1,600	-7,698	-5,598
Ft. Lupton	300	3,000	-3,942	-642
Lafayette ³	100	1,800	-4,926	-3,026
Total	2,400	21,300	-40,611	-17,020

¹Potential WGFP Firm Yield (in AF), based on Participants' Windy Gap units firm yield goal. The firm yield goal is the maximum that the project could yield. Firm yields could be less depending on the project alternatives and further hydrologic analyses.

²Includes 10 percent safety factor.

³Erie currently owns 14 Windy Gap units (1,400 AF) and Lafayette currently owns 1 Windy Gap unit (100 AF). However, Erie has requested 20 units (2,000 AF) from the WGFP and Lafayette has requested 8 units (800 AF), assuming that they will be able to acquire additional Windy Gap units. If Erie was able to acquire 2,000 AF in the WGFP, its 2050 excess would be 855 AF, and if Lafayette was able to acquire 800 AF from Windy Gap, its 2050 shortage would be 2,326 AF.

⁴It is possible that Evans' projected shortage in 2050 could range from 4,000 AF to 6,200 AF if Evans is able to change the water right for the Evans Ditch, either by changing the diversion point, exchanging water with an upstream user, constructing a treatment plant, or other means.

advertisements announcing public scoping meetings, a scoping announcement, and publication of Project information on the District web site and Corps website. An agency scoping meeting was held on September 21, 2004 at the District's offices in Berthoud. The agency scoping meeting also included a field trip to several of the elements included in the District's Proposed Action. Three public scoping meetings were held: September 20, 2004 at the Eaton Country Club; September 21, 2004 at the Lincoln Center in Fort Collins; and September 22, 2004 at the American Legion in Laporte, Colorado. All of the public scoping meetings lasted from 6:30 to 9:00 pm. Public comments were accepted until November 24, 2004. A scoping report was prepared and posted on the Corps website on March 30, 2005 (<https://www.nwo.usace.army.mil/html/od-tl/eis-info.htm>).

1.9.1 Key Issues Identified for Analysis in the EIS

This section identifies the significant issues to be addressed in the EIS. During scoping, comments were submitted, then categorized into several specific areas (ERO 2005a). Based on the issues and recommendations identified in the scoping comments, as well as guidance from NEPA, the following general categories of significant issues will be the focus of the EIS:

1. Surface Water
2. Stream Morphology
3. Water Quality
4. Water Rights
5. Ground Water
6. Geology
7. Soils
8. Vegetation
9. Noxious Weeds

10. Wetlands and Other Waters
11. Riparian Resources
12. Wildlife
13. Fish and Other Aquatic Life
14. Species of Concern
15. Recreation Resources
16. Cultural Resources
17. Aesthetics and Visual Quality
18. Traffic and Transportation
19. Land Use
20. Socioeconomic Resources
21. Hazardous Sites
22. Noise
23. Air Quality
24. Energy

1.10 FEDERAL AND OTHER DECISIONS, PERMITS, AND APPROVALS

A number of decisions, permits, and approvals are needed from federal agencies to implement the Project alternatives. As the lead federal agency, the Corps is responsible for NEPA compliance and has regulatory authority for any Section 404 dredge and fill permitting requirements under the Clean Water Act. The Corps is using this Draft EIS to meet NEPA compliance that may be required for its federal actions associated with NISP.

CDOT is a state cooperating agency and is responsible for evaluating the proposed realignment of U.S. 287 associated with the proposed Glade Reservoir. The EPA, a federal cooperating agency, is responsible for cooperating on issues for which the agency has expertise, review of the Section 404 permit application that the District will submit to the Corps, and review of the EIS.

In addition to meeting the Corps' NEPA requirements, the NISP EIS also will meet NEPA

requirements for CDOT and Reclamation so that these agencies can adopt the EIS to meet their NEPA requirements associated with their respective responsibilities. Reclamation and CDOT will not prepare NEPA documents separate from the NISP EIS; Reclamation will prepare a separate ROD that addresses its action, and CDOT will adopt the Corps' ROD.

The U.S. Fish and Wildlife Service is a cooperating agency, and is responsible for consultation with the Corps and the District under the Endangered Species Act and the Fish and Wildlife Coordination Act. The Service will consult regarding potential impacts to federally listed threatened or endangered species and their designated critical habitat based on the Biological Assessment prepared by the Corps and submitted to the Service and the Fish and Wildlife Coordination Act Report prepared by the Service.

1.10.1 Corps Decisions

As the lead agency, the Corps is responsible for preparation of the EIS and ROD. In addition, the Corps must make several decisions regarding potential actions associated with implementation of the Proposed Action or other alternatives. The Corps will decide whether to issue a permit under Section 404 of the CWA.

1.10.2 Other Permits and Approvals

Larimer County is a cooperating agency and through its location and extent review process, must render a decision about the portions of the project located in Larimer County and their consistency with the County's Master Plan.

Implementation of any of the action alternatives will require compliance with applicable state and local regulatory agency reviews, approvals, and permitting requirements. Principal federal, state,

and local environmental compliance requirements associated with implementation of NISP are presented in Chapter 6.

1.10.3 The EIS Process

The Corps, as the lead agency, is responsible for NEPA compliance including preparation of the EIS. This Draft EIS analyzes the Proposed Action and alternatives and their impacts on the environment. It was prepared in accordance with the National Environmental Policy Act of 1969 and amendments, Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Part 1500-15-8), and the Corps' NEPA requirements (Appendix B of 33 CFR (Part 325) and the 404(b)(1) guidelines (40 CFR Part 230). A 404(b)(1) analysis has been prepared as part of the EIS process (Appendix D). The EIS also addresses the information requirements associated with the Corps' public interest review (33 CFR Part 320.4).

The Draft EIS will be released to the public for a 90-day comment period. During this period, the Corps will hold public hearings to take comments on the Draft EIS. Following receipt of comments, the Corps will respond to substantive comments on the alternatives and the impact analysis and include these responses in the Final EIS. A Final EIS will be completed about 4 to 5 months following the release of the Draft EIS depending on the number of comments. The Corps' decision on the Proposed Action and alternatives will be documented in a ROD.

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Chapter 2

Proposed Action and Alternatives

The Town of Berthoud has withdrawn from NISP. All references to Berthoud should be ignored. Berthoud's contract in NISP has been acquired by Frederick, which is served by the Central Weld County Water District. This change will be reflected in the Final EIS.

This chapter discusses the alternatives development selection and screening process, and the concepts and elements used to develop the alternatives. This chapter also describes the alternatives evaluated for NISP to provide the Participants with approximately 40,000 AF of new reliable municipal water supply annually. Four alternatives, including a No Action alternative and the Proposed Action, were selected for evaluation in the EIS. The alternatives are:

- No Action alternative — Participants would develop independent water supplies by purchasing water rights and pursuing independent storage and conveyance systems in the absence of NISP.
- Proposed Action — Glade Reservoir (170,000 AF) and the SPWCP.
- Cactus Hill Reservoir (180,000 AF) and the SPWCP.
- Glade Reservoir (170,000 AF) or a Cactus Hill Reservoir (180,000 AF) combined with agricultural transfers and a reduced SPWCP.

The chapter ends with a discussion of related federal actions, and a summary comparison of alternative features and costs.

2.1 ALTERNATIVE SCREENING AND SELECTION PROCESS

The goal of the alternatives selection process is to identify a reasonable range of alternatives with potential to meet the purpose and need of the proposed NISP. NEPA requires that the NISP EIS

evaluate a range of reasonable alternatives including the No Action alternative. NEPA regulations do not specify the number of alternatives that need to be considered in the EIS, but indicate that a reasonable range of alternatives should be considered.

The Council on Environmental Quality (CEQ) defines reasonable alternatives as “those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant” (CEQ 1986). CEQ regulations also require that all reasonable alternatives, including no action, are rigorously explored and objectively evaluated and that the reasons for eliminating alternatives are discussed (40 CFR 1502.14).

In addition to satisfying NEPA requirements, projects subject to permitting by the Corps under the Clean Water Act also must comply with the Section 404(b)(1) guidelines (40 CFR, Part 230) for discharge of dredge and fill material into waters of the U.S. The Section 404(b)(1) guidelines require that the Corps permits the least environmentally damaging practicable alternative (LEDPA). These guidelines specify “no discharge of dredge or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.” An alternative is considered practicable if “it is capable of being done after taking into consideration cost, existing technology, and logistics in the light of overall project purposes.” Practicable alternatives under the guidelines assume that “alternatives that do not involve special aquatic sites are available, unless clearly demonstrated otherwise.” The guidelines also assume that “all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are

presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise.”

The alternatives analysis required for Section 404(b)(1) guidelines can be conducted either as a separate analysis for 404 permitting or incorporated into the NEPA process. The Corps has integrated NEPA and 404(b)(1) guidelines into the alternatives analysis. Integration of both NEPA and 404(b)(1) guidelines ensures that the alternatives selected for evaluation in the EIS provide a reasonable range of alternatives and that the alternatives are practicable.

2.1.1 Development of Alternatives

2.1.1.1 Independent Review of NISP Alternatives Evaluation

In 2003, prior to the NISP EIS and as part of the development of a reliable future regional water supply for the Participants, the District studied potential Project alternatives (Phase II report, MWH 2004). The Corps’ independent analysis of the Phase II report is summarized in Volume I of the Northern Integrated Supply Project EIS Alternatives Evaluation Report (HDR 2007a). Volume II of the Phase II report includes the Corps’ independent alternatives analysis, screening process, and action and No Action alternatives selection (HDR 2007a).

The Phase II report used a multi-tiered screening process through which water supply concepts and elements were screened, and those that passed screening were used to develop a set of alternatives. The Phase II report began with general project ideas that were screened on a qualitative basis with a pass/fail determination. The evaluation process became increasingly more detailed and quantitative as the number of project ideas was reduced.

2.1.1.2 *Alternative Refinement*

The Corps reviewed the results of the Phase II report to determine the adequacy of the preliminary identification of potential alternatives and the analyses conducted prior to the EIS for NISP to select alternatives. The Corps determined the Phase II report provides an excellent compilation of data and alternatives analysis. However, further refinement of the alternative screening and selection process was needed to address the requirements of the 404(b)(1) guidelines. To comply with the 404(b)(1) guidelines, the Corps re-evaluated all of the alternatives identified in the Phase II report, as well as other new alternatives identified subsequent to the Phase II report and during scoping. Additional detail on the evaluation of alternatives is found in the Alternatives Evaluation Report (HDR 2007a).

2.1.2 *Alternative Screening*

The Corps' alternative screening process included three levels of screening (purpose and need, environmental, and practicability) to develop a

reasonable range of alternatives to be evaluated in the EIS. Screening criteria were developed and applied to 16 Project concepts (Table 2-1) and 215 elements. A Project concept is defined as a source of potential water supplies able to meet a substantial portion of the NISP Participants' requests. Concepts included general strategies or classes of potential structural or nonstructural solutions (e.g., storage in the Cache la Poudre River Basin (Poudre Basin) foothills or dry-year leases) that could be incorporated into comprehensive alternatives for meeting NISP objectives (MWH 2004). An element is defined as a storage facility capable of containing a portion of the 40,000 AF of new reliable municipal water supply that would be required annually by NISP. Elements included specific individual projects within a larger strategy or class of potential solutions (e.g., Cobb Lake enlargement, well fields in lower South Platte River Basin, or Glade Reservoir) (MWH 2004). The elements evaluated also included potential facilities in the following categories: reservoir rehabilitation, reservoir enlargement, new reservoirs, ground water, and gravel lakes (HDR 2007a).

Table 2-1. Project Concepts Evaluated for NISP.

Concept	Decision for Further Evaluation in EIS		Rationale for Retaining or Eliminating
	Retained	Eliminated	
Water rights development	X		Existing water rights owned by the District could feasibly supply the water needed and meet the purpose and need.
South Platte Water Conservation Project	X		Meets purpose and need and is a component of the Applicant's Proposed Action.
Agriculture-to-municipal transfers	X		The permanent removal of irrigation from agricultural lands and transfer of water rights to M&I use could feasibly meet a portion of the new firm yield required for NISP.
Agricultural water conservation (non-C-BT)		X	Does not meet the firm yield screening criterion and purpose and need.
Agricultural water conservation (C-BT)		X	Augmentation would be required, which would effectively reduce the firm yield of NISP; conserved water would be subject to diversion by water rights senior to NISP; does not provide a reliable firm supply and does not meet purpose and need.
Colorado River return project		X	Fails to meet timeliness and reliability criteria; is outside the assessment area and does not meet purpose and need.
Cloud seeding		X	Fails to provide a reliable new firm yield and does not meet the purpose and need.
C-BT Project re-operation		X	Would not provide a reliable source of new firm yield from within the NISP geographic area; fails to meet the logistics criterion and purpose and need.
Foothills/plains storage transfer		X	Does not provide a reliable firm yield; many of the potential reservoir sites are located on perennial streams and wild and scenic segments of the Poudre River; does not meet the timeliness criterion and does not meet purpose and need.
Forest management		X	Does not provide a reliable new firm supply; does not meet the land use criterion and does not meet purpose and need.
Ground water development (alluvial and bedrock)		X	Does not provide a reliable new firm yield and does not meet purpose and need.
Leases of excess Windy Gap units		X	Does not provide a long-term source of firm yield and does not meet purpose and need.
Phreatophyte removal		X	Does not provide a reliable new firm supply and does not meet purpose and need.
Reusable wastewater return flows		X	Does not provide a reliable new firm supply and does not meet purpose and need.
Temporary dry-year transfers		X	Does not provide a reliable new firm supply and does not meet purpose and need.
Water banks		X	Does not provide a reliable new firm supply and does not meet purpose and need.

2.1.2.1 Purpose and Need Screening Criteria

Both NEPA and the 404(b)(1) guidelines recognize that alternatives must address a project's purpose and need. Alternatives need to achieve basic goals that are established in the purpose and need statement. The purpose and need for NISP are presented in Chapter 1. The Project concepts and elements were screened using three purpose and need criteria: firm yield, timeliness, and regional project, as described below.

Firm Yield. The firm yield screening criterion requires that viable water supply sources must be capable of providing a firm annual water yield. This screening criterion was only applied to concepts because concepts are defined as a source of potential water supplies able to meet a portion of the NISP Participants' request. To pass this criterion, concepts must be able to provide at least 30 percent of the total requested firm annual yield of 40,000 AF, which is 12,000 AF. Limiting the provisional percentages reduces the number of water supply sources to a maximum of four, which is logistically reasonable for a regional water supply project of this magnitude.

Timeliness. The majority of NISP Participants have an immediate need for water because between 2005 and 2010, the total demand of all the Participants combined will exceed their combined firm annual yield, as described in Table 1-10 in Chapter 1. This screening criterion is reflected in the NISP purpose and need statement as "current and reasonably projected future additional water supply needs." Elements, concepts, or alternatives that could be held in extensive litigation or by other timeliness issues were eliminated.

Regional Project. NISP is a regional water supply project addressing a portion of the current and anticipated water supply needs of 12 Participants

providing water to an area of about 945 square miles. Concepts, elements, and alternatives that would not assist in providing the Participants with a common solution were eliminated from further review.

2.1.2.2 Environmental Screening Criteria

The 404(b)(1) guidelines state that "no discharge of dredge or fill material will be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences" (40 CFR 230.10(a)). To address this "less adverse impact" requirement, coarse environmental screening criteria were formulated involving wetlands and waterways. A screen for threatened and endangered species critical habitat also was developed and was considered an "other significant adverse environmental consequence." These screens were applied solely to elements. This level of environmental analysis allows for the elimination of those elements that result in the largest and most extensive direct environmental impacts in accordance with 40 CFR 230.10(a).

Wetlands. Wetlands are special aquatic sites as defined in 40 CFR 230.41 and are part of the aquatic ecosystem. Elements that passed this screen did not cause permanent, direct loss to 60 acres or more of wetlands. Wetland areas were estimated using National Wetland Inventory maps, the Phase II report (MWH 2004), and/or geographic information system (GIS) tools, as discussed in the Alternatives Evaluation Report (HDR 2007a).

The 60-acre limit was developed by plotting the number of potential facilities with wetlands versus wetland acres on a graph (e.g., there are about 40 facilities with 10 or fewer acres of wetlands, and

about 80 facilities with 120 or fewer acres of wetlands). A noticeable change in the slope of the graph occurred at about 60 acres of wetlands. The slope change is a reasonable estimation of where the wetland area differential diminishes as a screening tool. Therefore, by using this break point as a screening criterion, a large number of elements that would have caused a significant loss to aquatic habitat were eliminated from further evaluation.

Waterways. Waterways are part of the aquatic ecosystem and are defined as perennial streams for the NISP EIS analysis. Perennial streams were selected as a screen because they have continuous flows and typically support a stable aquatic environment. A stream or creek was considered perennial if it is labeled as such on a USGS topographic map. This screen was applied to possible reservoir sites. A reservoir site located on a perennial stream would likely cause greater direct permanent losses to typically higher functioning aquatic habitats (they provide wildlife habitat or other benefits) compared to potential reservoir sites not located on perennial streams. Therefore, any new proposed reservoir element located on a perennial stream was eliminated from further evaluation.

2.1.2.3 Practicable Screening Criteria

The 404(b)(1) guidelines state that an alternative is considered practicable if “it is capable of being done after taking into consideration cost, existing technology, and logistics in the light of overall project purposes” (40 CFR 230.10(a)(2)). Therefore, the practicable screening category includes logistics and existing technology. A cost screen was not used because it was determined that information on costs that could render an alternative not practicable were not available and were unlikely to help differentiate alternatives at this stage in the screening process.

Logistics. The logistics criterion was divided into screens for land use, element capacity, and elements that are integral to the development plans of others.

Land Use. The water sources or infrastructure components for NISP must not lie within areas that clearly create a significant obstacle in the evaluation process. Any project feature (a specific project element, such as a reservoir) located in the following sites would be explicitly forbidden by either statute or regulation, or would be extremely difficult to accomplish or construct:

- Designated wild and scenic or recreational segments of the Cache la Poudre River
- North St. Vrain Creek above 6,550 feet in elevation, which is protected from dam construction by existing legislation
- Designated or proposed wilderness areas
- Designated hazardous materials sites
- Landfills
- Active or abandoned mineral or coal mines
- National and state parks
- Locations that would necessitate relocation of an interstate highway

National and state parks and designated wild and scenic river segments or wilderness areas were established to create or preserve, in varying degrees, areas of common usage, aesthetics, environmental values, and ecosystems. Construction of project infrastructure within these areas would be incompatible with the values to be preserved. Project features must not involve relocation of interstate highways, which are critical infrastructure and would involve significant effort and likely project delays to relocate.

Water quality is a primary concern for potentially contaminated sites (e.g., hazardous materials sites, landfills, mineral or coal mines) because of the increased risk of exposure of public water supplies

to deleterious chemicals and materials. Additionally, extreme or potentially unproven technological or engineering solutions likely would be required to ensure the long-term viability of the water supply at these sites.

The Alternatives Evaluation Report (HDR 2007a) lists a number of hazardous land uses (such as landfills, industrial waste disposal wells, salvage yards, and mines) and various contaminants associated with each of these types of sites. A water source or infrastructure component site located in any of these areas either cannot be implemented within the reasonable future, is unlikely to be permitted, or requires extreme technological or engineering solutions and is therefore not considered for further evaluation in the EIS.

Geographic Location. Only project features within the State of Colorado were considered. The river basins considered were the South Platte River and its tributaries, the Colorado River, the Yampa River, and the Green River.

Projects on the West Slope (the Colorado, Yampa, and Green rivers) would add significant challenges to the alternatives development and screening process that are not justified logistically, and the projects would not meet the timeliness criterion. For example, sources outside the South Platte River Basin would necessitate acquiring water rights through new filings or by purchasing and transferring existing water rights from current users in other basins (see Water Rights Development section). Extensive new infrastructure (or a change in use of existing facilities) also would be required to move those water sources to the NISP area within the South Platte River Basin. Obtaining water outside the South Platte River Basin would be extremely difficult or impossible to accomplish within a timeframe consistent with the NISP purpose and need. Any elements or concepts outside the

South Platte River Basin were eliminated from further evaluation. After initially considering other basins, it was determined that project features located in the South Platte River Basin within Larimer, Boulder, Weld, or Morgan counties were the features that had a possibility of meeting the timeliness criterion. Many options were identified in these counties, and all of the NISP Participants are within these counties.

Element Capacity. To reduce the number of elements required to meet the Project storage requirement of at least 160,000 AF, elements must have a storage capacity of 25,000 AF or greater. This capacity would limit the maximum number of elements required for meeting the purpose and need to six. Storage elements of at least 25,000 AF could be coupled with larger storage facilities to achieve the purpose and need and maintain a range of alternatives to be investigated involving smaller components. Any more than two or three storage elements in one alternative would be too complex to reasonably implement and manage. Beyond six, the reservoirs would be so numerous and likely downsized to such an extent that they would be considered local facilities serving only those Participants in the immediate vicinity, and NISP would not function as a regional project. Therefore, any element with less than 25,000 AF was eliminated from further review.

Integral to Other Development Plans. The water sources or infrastructure components for NISP must not lie within areas known to be integral to the development plans of other entities. Considerable conflicts, time delays, and costs are associated with preempting or displacing an already planned development. Moreover, the time delay associated with possible conflicts would not meet the timeliness criterion.

Sites or areas currently and publicly part of an active permitting process or in any way part of a known, active development plan by an entity with credible standing and capability to advance the plan were eliminated. This criterion does not necessarily preclude alternatives that could be developed jointly under a cooperative effort.

Existing Technology. To be retained for further evaluation, elements, concepts and alternatives must be able to be constructed using a proven technology and managed using proven practices. Any component not capable of utilizing proven technology to provide the required firm yield was eliminated from further evaluation.

2.1.3 Concepts

Concepts were evaluated and screened according to the NISP screening criteria previously described. Of the original 16 concepts, three concepts—water rights development, South Platte Water Conservation Project, and agriculture to municipal transfers—were retained for further evaluation in the EIS (Table 2-1). Concepts retained and eliminated, and the reasons they were retained or eliminated, are summarized in Table 2-1 and described in greater detail in the Alternatives Evaluation Report (HDR 2007a).

Although agricultural water conservation (both C-BT and non-CBT) was evaluated as a potential water supply source (concept) for NISP, M&I water conservation was not. As discussed in Chapter 1, conservation plays an important role in each of the NISP Participants' present and future water demands, and is therefore represented as a reduction in demand for NISP rather than as an additional source of water. For the purposes of NISP analyses, M&I water conservation is regarded as an active demand management strategy. All Participants plan to maintain current conservation practices and some

will implement additional measures in the future (Harvey Economics 2006). M&I conservation may stretch the individual Participants' existing supplies, but it is not a viable source of new firm water supply for NISP as a regional project.

2.1.3.1 *Concepts Considered and Retained*

Water Rights Development. The District investigated the possibility of developing existing conditional water rights or acquiring new water rights in the Big Thompson River Basin, the St. Vrain Creek Basin, the Poudre Basin, and the lower South Platte River Basin (MWH 2004). The Colorado River, Green River, and Yampa River basins also were considered as part of the EIS analysis. Storable flows are insufficient to justify filing for new junior water rights in the Big Thompson River and St. Vrain River basins (under Colorado's appropriation system, a new water right would be junior to existing (senior) water rights, and would have lower priority). Furthermore, the development of (or filing for) new water rights on the St. Vrain is considered infeasible because of the existing large conditional water rights in the basin. Likewise, divertible flows would be virtually nonexistent for a new water right in the Poudre Basin with an appropriation date of 2006 or later (HDR 2007a). Possible water rights transfer from the Colorado River were examined as part of the EIS. The District would need to adjudicate (file for a new) a water right, which would have an adjudication date of 2007. A 2007 adjudication date would not produce the water needed for NISP (HDR 2007a).

The Green River Pipeline Project also was examined as a potential source of supply for NISP. The Green River Pipeline Project would deliver water from the Green River, near Flaming Gorge Reservoir, and pipe the water to the Front Range. This proposed

project is in the initial planning stages, and does not meet the timeliness criterion for NISP.

Also in the preliminary planning stages is the District's proposed Yampa River project. This long-term project has no defined purpose and need nor have the participants been identified. A series of water compact studies would need to be performed, in addition to feasibility studies, NEPA, and other permitting. The proposed Yampa River project does not meet the timeliness criterion for NISP.

The District has existing conditional water rights on the Cache la Poudre River and the South Platte River that could be used for NISP. These are the water rights for the proposed SPWCP, which were decreed on November 28, 2005, with most components having an appropriation date of December 11, 1992. Due to the recent timing of the decree for the SPWCP water rights, they were considered to be "new" during the evaluation process.

In addition, the District has an existing conditional water right (the Grey Mountain water right) with storage at the Glade Reservoir site. This water right is a junior water right (May 2, 1980 priority), and divertible water is available primarily during high flows. Currently, the Grey Mountain water right is not useable by the District because no facility exists to store high flows. The District proposes to construct Glade Reservoir to store these flows as a component of NISP.

One other existing conditional water right, the storage right for the proposed Hardin Dam and Reservoir, is potentially available to NISP because the District owns one-third of the right. Because the Hardin Dam site is on the lower South Platte River, the water quality is not suitable for direct M&I use for NISP. However, the potential exists to use the Hardin water right by exchange or by moving a part of the storage right to an alternate location such as the proposed SPWCP storage location. The Hardin

water right would not achieve any priority advantage for NISP over the SPWCP rights (HDR 2007a). As a result, the Hardin water right is not retained for NISP. The District abandoned the Hardin water right in 2008.

The water rights development concept was retained because use of the Grey Mountain water right (proposed to be transferred to an off-channel reservoir) and the water rights for the SPWCP associated with the District's Proposed Action are considered to be feasible, and meet the Project purpose and need.

South Platte Water Conservation Project. The proposed SPWCP would capture storable flows in the lower Poudre Basin and the South Platte River Basin using the District's new conditional water rights described in the previous section. Water from these sources would be stored in a reservoir (e.g., Galeton), primarily during the winter months. It would then be delivered to Poudre Basin agricultural water users during the growing season to facilitate exchanges to a NISP primary storage facility upstream in the Poudre Basin (MWH 2004; HDR 2007a). The SPWCP is a component of the Applicant's Proposed Action and meets the NISP purpose and need; therefore, this concept was retained for further analysis in the EIS.

Agriculture to Municipal Transfers. The concept of transferring agricultural water rights to municipal uses was investigated as a means to obtain new firm yield for NISP. Agriculture accounts for most of the water use in Colorado, and agricultural users often hold many of the most senior and therefore most reliable water rights under Colorado's prior appropriation system. Because new, undeveloped water rights are increasingly scarce, and because towns in the region typically expand into historically irrigated cropland and rangeland, transfers of agricultural water to municipal uses are a potentially

viable way to obtain water. This concept was investigated as a means to obtain the entire new firm yield required for NISP or as a means to obtain a part of the water supply needed for NISP. Agricultural to municipal transfers are subject to the “no injury” rule, and only the historical consumptive use of an agricultural water right can be transferred.

For NISP, the following potential scenarios of agricultural to municipal transfer concepts were considered (HDR 2007a):

- Partial supply, preserve agriculture – obtain at least 30 percent (12,000 AF) of firm yield for NISP and preserve agriculture by leasing water back to agricultural users on a rotating basis.
- Full supply, preserve agriculture – obtain all 40,000 AF of firm yield, but preserve agriculture by leasing the water back to agricultural users through a rotating fallow program.
- Full supply, permanently remove irrigation from agriculture lands.
- Partial supply, permanently remove irrigation from agriculture lands.

The first scenario (partial supply, preserve agriculture) was eliminated because it fails to meet the timeliness screening criterion for NISP. To facilitate a rotating fallow program (designed to keep agricultural land in production) that also would allow NISP to generate 12,000 AF of firm yield each year, NISP would have to purchase at least 103,000 AF of agricultural water (HDR 2007a). It would take many years to transfer the amount of water necessary for this scenario—with considerable time spent negotiating with water right holders and processing the water rights transfers through the state water court. The water purchased by NISP to implement this scenario is unlikely to be available to the Participants within the near-term time frame required by the timeliness screen (HDR 2007a).

Additionally, any acquisition of less than 103,000 AF of agricultural water would hinder NISP from producing 12,000 AF of annual firm yield while still operating a functional rotating fallow program. As a result, the partial supply, preserve agriculture scenario likely would fail to meet the minimum firm yield criterion for NISP.

The full supply, preserve agriculture scenario would fail to meet the NISP firm yield for the same reasons as the partial supply, preserve agriculture scenario discussed above. The amount of agricultural water required to produce 40,000 AF of firm yield for NISP while running a successful rotating fallow program to keep agricultural land in production would be far in excess of the 103,000 AF required for the partial supply option (HDR 2007a). Again, the purchase and transfer process would exceed the limitations of the timeliness criterion. It also would be nearly impossible to guarantee that enough water could be purchased to satisfy the full firm yield demand through this full supply, preserve agriculture scenario.

For the full supply, permanently remove irrigation from agricultural lands scenario, there are two options. The first option would be to purchase C-BT units from ditch companies. Excluding the North Poudre Irrigation Company (70 percent municipal ownership at present), about 74,000 C-BT units remain in agricultural ownership. Assuming all C-BT units could be purchased by NISP, the firm yield would be 37,000 AF based on a 0.5 minimum quota.

Throughout the 50-plus years that the C-BT Project has been in operation, the annual quota has ranged from 0.5 to 1.0, with an average of about 0.7. This quota represents the fraction of 1 acre-foot that allottees receive for each C-BT unit owned. For the agriculture to municipal transfer concept, a quota of 0.5 was used because the most conservative approach to determining available water supply is to

evaluate the minimum yield. A C-BT quota of 0.6 has been determined to be appropriate for firm yield projections for the Windy Gap Firming Project analyses (ERO 2006a) and for NISP (HE 2006). Although there is a discrepancy between these values, the 0.5 quota is reasonable and appropriate for the various analyses (e.g., agricultural transfers and agricultural conservation) conducted for the NISP EIS (HDR 2007a).

Because the objective of this particular scenario is to produce the full 40,000 AF firm yield for NISP, the scenario fails to meet the NISP purpose and need. Alternatively, the full NISP supply could reasonably be met by a combination of agricultural water rights and C-BT units (HDR 2007a). This scenario has been identified as a major component of the No Action alternative.

The second option is the extensive transfer of agricultural water rights. It is estimated that about 12,000 AF of new firm yield required for NISP could be obtained. This is the partial supply, permanently remove irrigation from agricultural lands scenario, and has been retained for further analysis in the NISP EIS.

Screening of the four agriculture-to-municipal transfer scenarios produced the following results:

- Partial supply, preserve agriculture: eliminated.
- Full supply, preserve agriculture: eliminated.
- Full supply, permanently remove irrigation from agricultural lands: C-BT only eliminated, C-BT plus water rights retained as part of the No Action alternative.
- Partial supply, permanently remove irrigation from agricultural lands: retained.

2.1.3.2 Concepts Considered but Eliminated

Agricultural Water Conservation – Non-C-BT. Agriculture accounts for most of the water use in

Colorado. Consequently, agricultural water supplies often are seen as a way to meet growing municipal demands. The EIS team examined the concept of agricultural water conservation as a supply for NISP. Decreases in irrigation water use can be achieved by structural improvements and maintenance in the application systems of target lands, e.g., better maintenance of existing canal, ditch and irrigation systems; irrigation management techniques; altered tillage and soil management; or changes in the crops grown.

Some water losses are consumptive, meaning that the water is permanently lost from the system and cannot be recovered and other losses are nonconsumptive, meaning that water is not lost or losses can be recovered. Consumptive losses include evaporation, seepage into geologic zones not hydraulically connected to surface streams, and transpiration by non-agricultural vegetation. Non-consumptive losses are associated with return flows, or water returning to the stream from which it was diverted. Losses resulting in return flows include deep percolation from ditches and fields into tributary aquifers, necessary or accidental water spills from distribution systems, and tailwater or unused irrigation water. Return flows are available to downstream appropriators, and are not considered a consumptive use.

Improving irrigation efficiency by improving water delivery and irrigation systems or changing crop and land management practices could potentially provide an additional water supply. The concept of non-C-BT agricultural water conservation was eliminated during the NISP screening process because Colorado water law does not allow an entity to take direct ownership of salvaged or saved water, with the exception that saved water may be used to meet shortages within the original water right. Otherwise, any non-C-BT direct flow water conserved (i.e., salvaged or saved) under this alternative would

revert to the river and be administered by the division engineer under the prior appropriations system (HDR 2007a). NISP could divert water made available by a non-C-BT agricultural conservation program subject to the priority of its water right. However, with the junior priorities of the existing water rights held by the District and any new filings having 2006 or later appropriation dates, it is a probable risk that senior water rights would divert most or all of the water to meet senior water rights holders needs before the conserved water would become available to NISP (HDR 2007a).

As discussed in the Alternatives Evaluation Report, modeling of conservation measures that would “save” water from the Larimer-Weld and New Cache canals produced a yield of 8,250 AF, which is about 20 percent of the 40,000 AF needed for NISP, which is below the screening threshold that a water source must provide at least 12,000 AF (HDR 2007a). In addition, the success of agricultural conservation programs depends on the maintenance of current levels of agricultural irrigation, which is not a reliable assumption for NISP.

This concept was eliminated for the following reasons:

- The concept does not meet the firm yield screening criterion.
- The concept does not meet requirements of the NISP purpose and need.

Agricultural Water Conservation – C-BT. The concept of conservation of agricultural C-BT water also was investigated for NISP. Through this concept, NISP would execute an agricultural water conservation program on irrigation ditch systems that derive at least a portion of their overall water supplies through ownership of C-BT units. Conceptually, C-BT agricultural water conservation would operate as follows: NISP would pay for

irrigation system efficiency improvements such as canal lining. The improvements would be designed to “free up” a quantity of water equal to the ditch system’s annual C-BT allotment. To be conservative and consistent with the need for firm yield for NISP, the calculations of conserved water were based on a minimum C-BT quota of 0.5. That is, each C-BT unit would receive the minimum annual allocation of 0.5 AF; the maximum is 1.0 AF per unit, with an average of 0.7 AF per unit (HDR 2007a).

With ditch system improvements in place to eliminate the need for a quantity of water based on the 0.5 quota, NISP would then purchase the ditch company’s C-BT units outright and transfer them to municipal use. It is important to note that improvements to ditch systems would benefit all water users in the ditch system, not just individual C-BT unitholders. Therefore, any savings from agricultural conservation of C-BT units would be distributed among all of the ditch shareholders.

Fundamentally, the idea behind an agricultural water conservation program is to maintain the historical level of consumptive use while reducing the amount of nonconsumptive “losses.” While envisioned to provide at least a partial supply (12,000 AF firm yield) for NISP, conservation of C-BT water in irrigation ditches could actually reduce the amount of native return flows available to downstream users. This loss would be considered injurious to those downstream users. Mitigation would be required, effectively negating much of the potential NISP supply obtained through the conservation program (HDR 2007a).

This concept was eliminated for the following reasons:

- The amount of C-BT water that could be conserved would have to be augmented to avoid injury to downstream users. This would

effectively reduce the potential firm yield for NISP.

- Conserved water would be considered “salvaged” or “saved” and, therefore, part of the stream system and subject to diversion by water rights senior to NISP. This would reduce the firm yield available for NISP.
- There is no guarantee that irrigation system improvements would produce the desired result.
- This concept does not provide a reliable, firm water supply.
- This concept does not meet the NISP purpose and need.

Colorado River Return Project (Big Straw). The Colorado River Return Project (CRRP), also known as the “Big Straw” project, was considered a potential water supply concept for NISP. The CRRP would be a means of recovering excess streamflow in the Colorado River that currently leaves Colorado because it cannot be captured by existing storage facilities. The CRRP would likely be state funded and likely consist of a diversion on the Colorado River near the Utah border, a pipeline to a West Slope storage reservoir (such as Dillon Reservoir), and additional infrastructure to deliver water to various water providers on the East Slope. It is estimated that the CRRP could pump from 280,000 to 400,000 AF annually. The 40,000 AF necessary for NISP would be a small portion of that amount. For CRRP water to be available for NISP, it likely would have to be conveyed through Denver Water’s system to users in the southern portion of the C-BT system, or water could be conveyed from Dillon Reservoir to the West Slope portion of the C-BT system to allow for increased deliveries through the C-BT infrastructure to NISP Participants (HDR 2007a).

The CRRP was eliminated as a concept for NISP for the following reasons:

- It fails to meet the timeliness criteria. Even if the CRRP were determined to be feasible, it would not be constructed in the timeframe established for NISP.
- It does not meet the reliability criterion for NISP because it is not known whether the CRRP is feasible or whether it ever would be built. Even if the CRRP were constructed, there is no guarantee that NISP would receive its full firm yield requirement.
- The CRRP is outside the assessment area that was looked at for NISP water supply options. Thus, the concept fails the geographic location screening criterion.
- This concept fails to meet NISP purpose and need and logistics criteria.

Cloud Seeding. Cloud seeding, or weather modification, has been in use in Colorado since 1951. Cloud seeding involves the stimulation of natural cloud processes using ground-based generators to burn a mixture of silver iodide and acetone that turns into a vapor. This vapor is carried into the clouds, where ice forms around the silver iodide and acetone particles (condensation nuclei). These ice particles turn into snowflakes. Cloud seeding may be conducted to increase precipitation, which benefits water users such as ski areas and municipalities, and for hail suppression.

Cloud seeding does not meet the reliability criteria for NISP because it depends on atmospheric variables that cannot be predicted accurately. To date, scientists have not documented if changes induced in clouds result in verifiable, repeatable changes in precipitation, although it is often claimed that cloud seeding may result in a 10 to 15 percent increase in snow pack (HDR 2007a).

The concept of cloud seeding was determined not to be a reliable source of new yield for NISP because it would be very difficult to quantify and take possession of the water generated by cloud seeding.

Any excess streamflow generated by cloud seeding would be subject to normal water rights administration (i.e., prior appropriation) and not directly tied to entities paying for the program.

This concept was eliminated because:

- This concept fails to provide a new reliable firm yield.
- This concept does not meet the NISP purpose and need.

C-BT Re-operation. NISP concepts are viewed as sources of new water supply. The only way that C-BT Project operations could be modified (re-operated) to facilitate the development of new water supplies for NISP would be to import additional water from the West Slope. Thus, the concept fails the geographic location screening criterion, which requires all NISP water supplies to come from the four-county (Larimer, Weld, Boulder, and Morgan) area in which all 12 Participants are located.

Water rights on the West Slope are not readily available, and likely could not be developed within a period of time that would meet the timeliness criterion for NISP (Montano 2006). Therefore, no water would be available for the re-operation of C-BT. The re-operation of C-BT would require review and approval by the Office of the Solicitor.

This concept was eliminated for the following reasons:

- The concept would not provide a reliable source of new firm yield from within the NISP geographic area.
- The concept fails to meet the NISP purpose and need and logistics criteria.

Foothills/Plains Storage Transfer. Under this concept, a portion of the water storage in plains reservoirs would be re-located (transferred) to reservoirs in the foothills or mountains. Free surface

water evaporation rates are higher on plains reservoirs than foothill or mountain reservoirs. The volume of water representing the difference in evaporation rates at the plains and foothills reservoirs would then be theoretically available as a supply for NISP (HDR 2007a).

Several potential foothills and mountain reservoir sites that either could be expanded or constructed were investigated, and none of them met the NISP screening criterion for not involving a perennial waterway. In addition, four of the six potential foothill or mountain reservoir sites are located on wild and scenic reaches of the Cache la Poudre River. In addition, this concept does not meet the NISP timeliness criterion because extensive scientific research would be required to determine accurate evaporation savings. It may not be possible to gather and analyze adequate data within the outlined timeframe for NISP.

This concept was eliminated for the following reasons:

- This concept does not provide a reliable firm yield.
- All six potential reservoir sites are located on perennial streams.
- Four of the six potential reservoir sites are located on wild and scenic reaches of the Cache la Poudre River.
- This concept likely does not meet the timeliness criterion.
- This concept fails to meet the NISP purpose and need.

Forest Management. Forest management consists of thinning of forests to increase runoff from snowmelt and rainfall. The water generated by increased forest thinning would theoretically increase runoff into the Cache la Poudre River. Under Colorado's prior appropriation water law system, increased streamflows generated through

forest thinning would most likely be identified as salvaged water. Water generated through forest management would not be available exclusively to the Project, but to all water users in order of priority. Consequently, forest management would not result in a firm water supply for NISP.

In addition, a successful forest management program requires at least 18 to 19 inches of precipitation. Average annual precipitation of this magnitude only occurs high in the Poudre Basin, where much of the land is within USFS designated Wilderness areas and Rocky Mountain National Park (HDR 2007a). This concept was eliminated for the following reasons:

- This concept does not provide a reliable new firm water supply.
- This concept does not pass the land use screen.
- The concept fails to meet the NISP purpose and need and logistics criteria.

Ground Water Development. The EIS team considered the concept of developing ground water resources as a potential water supply for NISP. Two types of aquifers could be considered for NISP—alluvial aquifers associated with the South Platte River Basin including the Poudre Basin; and bedrock aquifers of the Denver Basin (HDR 2007a).

The direct use of ground water from wells, the conjunctive use of ground water to supplement surface water yields during drought, and the storage capabilities of the alluvial and bedrock aquifers in Northern Colorado were assessed as part of the Phase II report (MWH 2004). Legal and institutional issues were investigated, as was ground water quality.

Alluvial aquifers underlie the Cache la Poudre River, the Big Thompson River, and St. Vrain Creek, but only the Poudre Basin has a significant, reliable aquifer capable of supporting agricultural

production. The alluvial aquifers in the Poudre Basin have been used extensively for irrigation. Ground water in the Poudre and South Platte River basins generally is of lower quality than surface water. Pumping ground water from these basins would require permits and water rights and the ground water may require extensive treatment to meet water quality standards. The bedrock aquifers of the Denver Basin also were investigated for the potential to provide the firm yield necessary for NISP. Available water in the Denver Basin aquifers beneath the project area is insufficient to meet the need for NISP (HDR 2007a).

Development of alluvial or bedrock aquifers was eliminated as a concept for NISP because there is inadequate supply and/or storage volume, and because neither the District nor the NISP Participants currently hold alluvial ground water rights to these aquifers needed to meet the NISP firm yield. If the District acquired new alluvial ground water rights, they would be very junior and would require the development of augmentation plans to provide a firm yield. Augmentation plans require decreed senior water rights to guarantee yield, which is generally as expensive as purchasing agricultural water rights (HDR 2007a).

This concept was eliminated for the following reasons:

- This concept provides an inadequate supply and/or storage to provide a reliable firm yield.
- This concept fails to meet the NISP purpose and need.

Leases of Excess Windy Gap Units. The concept of leasing excess Windy Gap units as a source of supply for NISP was evaluated. If the WGFP is completed, it is possible that excess units could be temporarily available to NISP Participants who also own Windy Gap units (HDR 2007a). By definition,

any concept that provides only a temporary supply fails to meet the firm yield screening criterion.

This concept was eliminated for the following reasons:

- This concept fails to meet the NISP purpose and need because excess Windy Gap units would be available only to the NISP Participants who own Windy Gap units.
- This concept does not provide a long-term source of firm yield for NISP Participants. Excess Windy Gap units likely would only be available temporarily because all WGFP participants face a shortage of water in the future.

Phreatophyte Removal. Phreatophytes are plants that grow in riparian areas and consume large amounts of water from the shallow alluvial ground water system. The majority of water expenditure in these riparian areas is from woody phreatophytes such as cottonwoods, willows, and salt cedars (tamarisk). Removing these plants in the NISP study area would reduce the amount of water consumption in the shallow alluvial system. Water made available to the stream through phreatophyte removal would be considered “salvaged” under Colorado water law and, therefore, could be diverted by all water rights owners in order of priority. As a result, the junior water rights that may be developed for NISP would not guarantee any firm yield (HDR 2007a).

Phreatophyte removal was eliminated because the concept does not provide a reliable firm supply of water for NISP and thus fails to meet the requirements of the NISP purpose and need.

Reusable Wastewater Return Flows. This alternative would involve capturing and recycling reusable sewer and unsewered return flows as described below, and making these flows available to NISP to meet nonpotable demands, to blend with

raw water supplies, or to use by exchange. In order to facilitate reuse, the original water sources must themselves be reusable. As discussed in the Alternatives Evaluation Report (HDR 2007a), examples of possible reusable water sources for NISP are:

- The historical consumptive use component of agricultural water transferred to municipal use;
- Water diverted through the proposed SPWCP, which is decreed to allow reuse to extinction; and
- Reusable return flows (treated effluent) from other water providers.

The SPWCP is a part of all three action alternatives being evaluated in the EIS; transfers of agricultural water are included in one action alternative. Assuming an action alternative is permitted for NISP, the water rights decree for the SPWCP requires the Division Engineer to approve the complex accounting procedures that would be required to track reuse. Similar accounting likely would be necessary for transferred agricultural water.

The fundamental reuse operation investigated for NISP would be for the Participants to return treated effluent to the nearest river. The reusable component of the effluent could then be recaptured by NISP at the SPWCP diversion headgate. There are, however, geographic limitations for some Participants located downstream of the SPWCP diversion point (e.g., Fort Morgan and MCQWD). Moreover, the various Participants are anticipated to use their NISP water supplies for different purposes and at different times of the year. Hydrologic and meteorological variations also likely would result in a different blend of NISP water being delivered to the Participants each year. These factors combine to make it nearly impossible to guarantee that reuse

could provide at least 12,000 AF of annual firm yield for NISP (HDR 2007a).

Other water providers (e.g., Denver Water, Aurora, Fort Collins, Greeley, Loveland, and Longmont) are expected to reuse most, if not all, of their own reusable return flows in the future. Even if reusable water were left in the stream, the quantities would very likely be insufficient to meet the minimum threshold of 12,000 AF (30 percent of the 40,000 AF of firm yield of NISP).

This concept was eliminated because it does not provide a firm supply of water for NISP and thus fails to meet the NISP purpose and need.

Temporary Dry-Year Transfers. The concept of temporary dry-year transfers of agricultural water to municipal uses, also known as temporary dry-year leases, was explored during the NISP Phase II report (MWH 2004). Under this concept, an agricultural water right could be leased to a municipality on a temporary basis. Under Colorado water law, the water right may be leased up to 3 years in a 10-year period without seeking a formal change of use adjudication in state water court (HDR 2007a). If the lease is not exercised, the State Engineer may renew the lease agreement for another 10 years. Otherwise, the dry-year lease must be approved by the water court.

This concept has been envisioned as a way for municipalities to use agricultural water to improve the reliability of their water supplies on a temporary basis during drought years. During normal and wet years, the water would remain in use for agricultural purposes. Agricultural water right owners are compensated for their production losses in dry years, and municipalities improve the drought reliability of their water supplies (HDR 2007a).

While this concept may be useful for some municipalities, it does not meet the purpose and need

for NISP. Temporary dry-year transfers do not provide a reliable firm yield because the water would only be available in years with below average precipitation, and by definition only on a temporary basis. One NISP screening criterion is that a water source must meet at least 12,000 AF of new firm yield. In addition, the concept of dry-year transfers does not provide a reliable long-term supply of water for NISP. Because the District would not own the water, there would be no guarantee that the water right owner would lease the water right to the District in perpetuity.

This concept was eliminated for the following reasons:

- This concept does not provide a reliable firm yield.
- This concept would provide less than 12,000 AF of the new firm yield required for NISP.
- The dry-year leasing concept does not meet the NISP purpose and need.

Water Bank. The water bank concept was authorized by the Colorado state legislature in 2001. A water bank is an institutionalized process by which a water right owner can deposit a valid water use entitlement in the bank so that it is available for use by others, subject to certain fees and conditions. The water bank acts as a facilitator between water rights owners and renters. One large-scale basin-wide water bank is currently in operation in Colorado—a pilot project in the Arkansas River Basin. The Arkansas Valley water bank has had very little participation, and currently there is no water available in the Arkansas Valley water bank. No other water banks have been developed in Colorado (HDR 2007a). The District would have no reliable control over whether water would be available in the bank in perpetuity. Additionally, water may not be available from the water bank when needed for NISP.

The water bank concept was eliminated because it does not provide a reliable firm water supply.

Conservation by the Participants. The Participants' ongoing water conservation programs are discussed in Chapter 1. Conservation plays an important role in each NISP Participant's present and future water demands and is, therefore, represented as a reduction in demand for NISP rather than as an additional source of water. Therefore, conservation by the Participants was not considered a concept for the alternative development and screening process, but is represented in the estimation of future water supply demands.

2.1.4 Elements

As mentioned in Section 2.1.2, an element is defined as a storage facility capable of containing a portion of the 40,000 AF of new reliable municipal water supply that would be required annually for NISP. Assuming a 4:1 storage-to-yield ratio, the total storage requirement to meet the NISP purpose and need is at least 160,000 AF. Elements were divided into the following categories:

- Reservoir rehabilitation
- Reservoir enlargement
- New reservoir
- Ground water
- Gravel lakes

A total of 215 potential elements were screened and included 15 reservoir rehabilitation sites, 35 reservoir enlargement sites, 147 new reservoir sites, six ground water aquifers, and 12 gravel lakes (HDR 2007a). These elements were screened using the NISP screening criteria (Section 2.1.2). Not every screen was applied to every element. If an element was eliminated for an obvious reason such as wetlands, waterway, or capacity, no further screens were applied. Therefore, once the element was

eliminated, there was no reason to examine it further. However, some elements did not pass multiple screens that were related (e.g., geographic location and land use or wetlands and waterways). Information on the various elements is summarized in the Alternatives Evaluation Report (HDR 2007a). Table 2-2 shows a breakdown of number of elements eliminated per screening criteria.

Following the screening and evaluation of 215 potential elements, 11 elements, all new reservoirs, remained. The elements associated with reservoir rehabilitation, reservoir enlargement, ground water, and gravel lakes were all eliminated (Table 2-3). A "best fit" evaluation was performed to compare equivalent elements from the short list. Equivalent elements are new reservoir sites similar in capacity, general location, and river basin. The best fit evaluation was completed based on environmental factors and capacity comparisons. Galeton Reservoir was retained as the best fit element in the lower South Platte River Basin because it has the fewest acres of wetlands among the equivalent elements. Cactus Hill Reservoir was retained as the best fit element in the Poudre Basin because it has the fewest acres of wetlands among the equivalent elements (HDR 2007a).

The three retained concepts and retained best fit elements were then combined to develop a reasonable range of alternatives. The alternatives developed for evaluation reflect the combined retained concepts and elements (Table 2-3).

Table 2-2. Number of Elements Screened.

Category	Number of Elements Screened	Purpose and Need		Practicable						Environmental	
				Logistics					Existing Technology	Wetlands	Waterways
		Timeliness	Regional Project	Land Use	Geographic Location	Element Capacity	Not Integral to Other Development Plans	No Congressional Action Required	Construction, Operation, and Safety Factors		
Reservoir Rehabilitation	15	0	0	0	0	13	0	0	0	0	2
Reservoir Enlargement	35	2	0	2	2	23	4	1	1	7	9
New Reservoir	147	5	0	14	23	68	1	0	4	10	97
Ground Water	6	0	0	0	0	0	0	0	6	0	0
Gravel Lake	12	0	6	0	0	6	0	0	0	0	0
Total	215	7	6	16	25	110	5	1	11	17	108

Table 2-3 Retained Concepts and Elements Combined to Develop Alternatives.

Alternative	Concept	Element
No Action	Agricultural to municipal transfers	Gravel lakes ¹
Glade Reservoir and SPWCP	Water rights development and SPWCP	Glade Reservoir and Galetton Reservoir
Cactus Hill Reservoir and SPWCP	Water rights development and SPWCP	Cactus Hill Reservoir and Galetton Reservoir
Glade Reservoir and SPWCP with Agricultural Transfers and Cactus-Hill Subalternative	Water rights development, SPWCP and agriculture to municipal transfers	Glade Reservoir, Galetton Reservoir, and Cactus Hill Reservoir

¹Gravel lakes were not retained as an element for the action alternatives because gravel lakes storage was determined not to be practicable for a regional water supply.

2.2 ALTERNATIVE 1—NO ACTION ALTERNATIVE

The No Action alternative considers what the Participants would do to meet their water supply needs in the absence of NISP. In the absence of NISP, obtaining new water supplies in the region likely would become more challenging because the demand for a finite supply of sources would increase. It is not possible to determine the specific mix of future water development approaches that would be pursued by the individual Participants or the region as a whole because the process of acquiring water supplies would be driven by complex social, economic, environmental, and political factors. Therefore, the No Action alternative is conceptual, and is intended to represent the possible water supplies that each Participant could obtain.

For the NISP No Action alternative, Participants were grouped based on factors such as geographic proximity, common sources of existing supply, likely pursuit of the same new sources of supply, and obvious advantages from shared conveyance and storage facilities (HDR 2007a). Four Participants (CWCWD, Evans, FCLWD, and Fort Lupton) were not grouped because implementation of the No Action alternative could most effectively be accomplished independently given their locations, water systems, and supplies. The Participants concurred that these are possible scenarios and actions they would pursue. The Participants were grouped for development of the No Action alternative as follows (Participant firm yield demands from NISP are identified in parentheses):

Group 1 – Southern Group

- Erie (6,500 AF)
- Lafayette (1,800 AF)
- LHWD (4,900 AF)

Group 2 – Northern Group

- Eaton (1,300 AF)
- Severance (1,300 AF)
- Windsor (3,300 AF)

Group 3 – Eastern Group

- Fort Morgan (3,600 AF)
- MCQWD (1,300 AF)

Independent Participants

- CWCWD (8,400 AF; this includes Berthoud's prior contract right that has been obtained by Frederick, which is served by CWCWD)
- Evans (1,600 AF)
- FCLWD (3,000 AF)
- Fort Lupton (3,000 AF)

2.2.1 Group 1—Southern Group

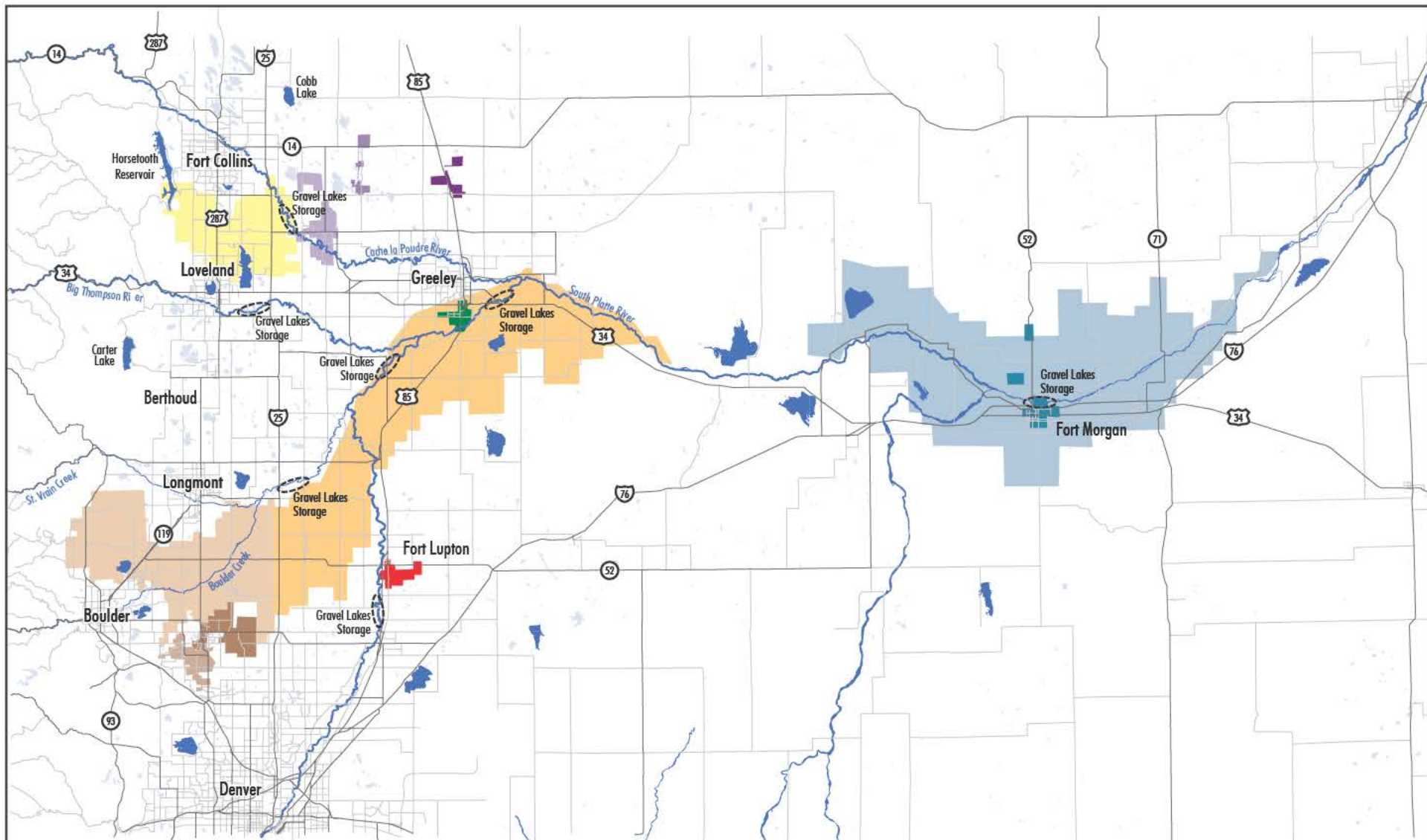
Group 1 (Southern Group) is composed of the towns of Erie and Lafayette, and the LHWD (Figure 2-1).

2.2.1.1 *Erie*

Erie is located in the Boulder Creek drainage, which has very limited water rights purchase and transfer potential due to prior acquisition by other municipalities. Current sources of supply include C-BT units and shares in local mutual irrigation companies.

2.2.1.2 *Lafayette*

Lafayette is located within the Lefthand Creek and Rock Creek drainages. Current sources of supply include C-BT units and shares in local mutual irrigation companies.



Prepared by:
ERO

Group 1 - Southern Group

- Erie (6,500 AF)
- Lafayette (1,800 AF)
- Left Hand Water District (4,900 AF)

Group 2 - Northern Group

- Eaton (1,300 AF)
- Severance (1,300 AF)
- Windsor (3,300 AF)

Group 3 - Eastern Group

- Fort Morgan (3,600 AF)
- Morgan County Quality Water (1,300 AF)

Independent Participants

- Evans (1,600 AF)
- Fort Collins-Loveland Water District (3,000 AF)
- Fort Lupton (3,000 AF)
- Central Weld County Water District (8,400 AF)



Figure 2-1
NISP Service Areas
and No Action
Alternative

Prepared for: U.S. Army Corps of Engineers
File: Figure 2-1.pdf
February 2008

2.2.1.3 Lefthand Water District

The LHWD is situated in the Lefthand Creek and St. Vrain Creek drainages. Current sources of supply include C-BT units and shares in local mutual irrigation companies.

2.2.1.4 No Action Alternative for Southern Group

Under the No Action alternative, the likely sources of new supply for the Southern Group would include:

- Purchase and transfer of agricultural water from ditches such as the South Boulder Canyon Ditch, the Leyner and Cottonwood #1 Ditch, the lower Boulder Ditch, the Coal Ridge Ditch, the Leggett Ditch, the Boulder and Weld County Ditch, and the FRICO-Community Ditch. Many of the ditches in this area are to a significant extent controlled by conservation easements by Boulder County Open Space. These easements restrict the water's use to irrigation purposes, precluding transfers to municipal use. Such arrangements must not be overlooked in identification of potential supplies.
- Purchase of C-BT units, which continue to decrease in availability and increase in cost.

Under the No Action alternative, at least 10,800 AF of storage would be required for the Southern Group. The most likely means of providing storage would be through development of gravel pit lakes along Boulder Creek downstream of Boulder or along St. Vrain Creek downstream of Longmont. A representative example gravel lake site for the Southern Group is the Shores pit, owned by the Hall-Irwin Corp. This gravel pit has a permitted acreage of 310 acres and an estimated storage volume of 10,850 AF (based on assumed average depth of 35 feet).

2.2.2 Group 2—Northern Group

Group 2 (Northern Group) includes the Towns of Eaton, Severance, and Windsor.

2.2.2.1 Eaton

Eaton is located north of Greeley, and current sources of supply include C-BT units and shares in local mutual irrigation companies. Eaton currently uses Horsetooth Reservoir as storage for the water it receives from the Poudre River and Big Thompson River.

2.2.2.2 Severance

Severance is located northwest of Greeley. Current sources of supply include wells, C-BT units, and shares in local mutual irrigation companies.

2.2.2.3 Windsor

Windsor presently receives water from Greeley, North Weld County Water District, and FCLWD.

2.2.2.4 No Action Alternative for Northern Group

Under the No Action alternative, the likely sources of new supply for the Northern Group are as follows: Eaton and Severance would require developers to purchase the water rights to support any new development, which will likely come from purchase of agricultural water and transfer for municipal use. Priority would be placed on additional purchases of shares from irrigation companies (e.g., North Poudre Irrigation Company and Larimer Weld Irrigation Company) that are already part of the portfolios of one of the Participants.

Under the No Action alternative, approximately 11,800 AF of storage would be required for the Northern Group. The most likely means of providing storage would be through development of

gravel pit lakes along the Poudre River in the reach between Fort Collins and Greeley. A representative example gravel lake site for the Northern Group is the Three Bells pit, owned by Lafarge West, Inc. This gravel pit has a permitted acreage of 360 acres and an estimated storage volume of 12,600 AF.

2.2.3 Group 3—Eastern Group

The Town of Fort Morgan and the MCQWD are the Participants in Group 3 (Eastern Group).

2.2.3.1 Fort Morgan

Fort Morgan participated in the Southern Water Supply Project to obtain new supplies of C-BT water primarily because of water quality considerations with its existing wells. Fort Morgan also has a few shares in local mutual irrigation companies. Under the No Action alternative, Fort Morgan would likely increase reliance on ground water and implement advanced treatment to deal with the water quality issues. Because the aquifers act as storage vessels for ground water supplies, implementation of the No Action alternative would not require Fort Morgan to construct any surface storage; however, Fort Morgan may need some storage for the necessary augmentation water obtained during the irrigation season for use year round.

2.2.3.2 Morgan County Quality Water District

The MCQWD serves land within the South Platte River Valley in Morgan County. MCQWD currently has three well fields that are approaching maximum capacity. As the well field capacity is reached, MCQWD will start taking delivery of C-BT water. MCQWD also requires new developers to purchase water as part of the development plan. Also, any new customer in the district is required to pay for three-quarters of a C-BT unit.

2.2.3.3 No Action Alternative for Eastern Group

Under the No Action alternative, the likely sources of new supply for the Eastern Group would include:

- Fort Morgan would likely continue to use its existing wells, acquire new wells, and implement advanced treatment such as reverse osmosis (RO) to meet state water quality requirements. If RO were used for advanced treatment, a mechanism for brine disposal would be required. Additionally, augmentation water would need to be secured to allow for well pumping.
- Purchase of agricultural water from South Platte irrigation ditches and transfer the water for municipal use. Priority would be placed on additional purchases of shares from ditches (e.g., Fort Morgan Canal) that are already part of the portfolios of one of the Participants.

Under the No Action alternative, approximately 6,200 AF of storage would be required for the Eastern Group. The most likely means of providing storage would be through development of gravel pit lakes along the South Platte River in the general vicinity of Fort Morgan. However, no representative gravel lake sites have been identified.

2.2.4 Independent Participants

Because of geography, infrastructure, or other constraints, implementation of the No Action alternative could be most effectively accomplished independently for the CWCWD (which supplies water to Frederick, Firestone, and Dacono), Evans, the FCLWD, and Fort Lupton.

2.2.4.1 Central Weld County Water District

The CWCWD serves lands primarily in the South Platte River valley between Fort Lupton and Kersey. Because CWCWD is representing Frederick, Firestone, and Dacono in NISP, efforts under the No

Action alternative would likely concentrate in the St. Vrain Creek Basin and the South Platte River valley. CWCWD could purchase and transfer shares in St. Vrain agricultural basin ditches such as the Highland Ditch, the Supply Ditch, or the Last Chance Ditch. To provide for a reliable firm supply under the No Action alternative, the CWCWD needs about 16,800 AF of storage. The most likely means of providing this storage would be through development of gravel pit lakes along the South Platte River to the east of Frederick, Firestone, and Dacono. A representative example gravel lake site for CWCWD is the Milliken Resource pit, owned by Aggregate Industries-WCR, Inc. This gravel pit has a permitted acreage of 493 acres and an estimated storage volume of 17,255 AF.

2.2.4.2 Evans

Evans' current supplies consist of C-BT and Windy Gap units plus shares in five local mutual irrigation companies. While owning raw water supplies, Evans receives treated water through Greeley's water system. Under the No Action alternative, Evans' most likely option for securing additional water is agricultural water transfers from the Big Thompson River Basin including such ditches as the Greeley-Loveland Irrigation Canal to provide for a reliable firm supply under the No Action alternative, at least 3,200 AF of storage would need to be constructed. Gravel pit lakes along the South Platte River in the vicinity of Evans would be the most likely means of providing storage. A representative example gravel lake site for Evans is the Durham Sand and Gravel pit, owned by Varra Companies, Inc. This gravel pit has a permitted acreage of 164 acres and an estimated storage volume of 5,740 AF.

2.2.4.3 Fort Collins-Loveland Water District

The FCLWD is a part of the collective known as the Tri-Districts. As participants in the Pleasant Valley

pipeline, the Tri-Districts have access to Poudre River water. Current sources of supply consist of C-BT units and shares in local mutual irrigation companies. In the absence of NISP, the FCLWD will most likely purchase additional C-BT units.

FCLWD would require approximately 6,000 C-BT units to meet its NISP firm yield demand under the No Action alternative. No surface storage would be required.

2.2.4.4 Fort Lupton

In the 1990s, Fort Lupton participated in the Southern Water Supply Project to obtain new supplies of C-BT water primarily because of water quality considerations with its existing wells. Fort Lupton presently blends its C-BT water with well water to meet Safe Drinking Water Act regulations. Fort Lupton also derives a portion of its supply from shares in the Fulton Ditch.

Under the No Action alternative, Fort Lupton could utilize its existing wells, acquire new wells, and implement advanced treatment, such as RO, to meet the water quality requirements. However, some mechanism for brine disposal would be required (e.g., evaporation ponds, landfilling, or deep-well injection), and Fort Lupton would have to develop new augmentation water—in addition to the reusable component of its effluent—to allow for continued well pumping.

Because Fort Lupton would use ground water wells, they may need about 3,000 AF of temporary storage for augmentation water. The most likely means of providing this storage would be through development of gravel pit lakes along the South Platte River in the vicinity of Fort Lupton. A representative example gravel lake site for Fort Lupton is the Platte Valley Operation pit, owned by Aggregate Industries-WCR, Inc. This gravel pit has

a permitted acreage of 141 acres and an estimated storage volume of 4,935 AF.

2.3 ACTION ALTERNATIVES — ACTIVITIES COMMON TO ALL ACTION ALTERNATIVES

The action alternatives (Alternatives 2, 3, and 4) have the following common components:

- Diversions from the Cache la Poudre River
- SPWCP and Galeton Reservoir (20,000 AF or 40,000 AF)
- Deliveries to the southern Participants
 - Bureau of Reclamation Contract Subalternative
 - Bureau of Reclamation No Contract Subalternative
- Deliveries to the northern Participants

2.3.1 Diversions from the Cache la Poudre River

All three action alternatives involve the diversion of water from the Poudre River for storage in either the proposed Glade Reservoir (Alternative 2 and Subalternative 4.1) or the proposed Cactus Hill Reservoir (Alternative 3 and Subalternative 4.2). The existing Poudre Valley Canal diversion would serve as the Poudre River diversion for all action alternatives. The Poudre Valley Canal diversion would require some upgrades to meet existing and NISP diversion requirements. The Poudre Valley Canal diversion is located near the mouth of Poudre Canyon (Figure 2-2). The proposed Glade Reservoir would also divert from the existing Munroe Canal diversion (Section 2.4.1.7).

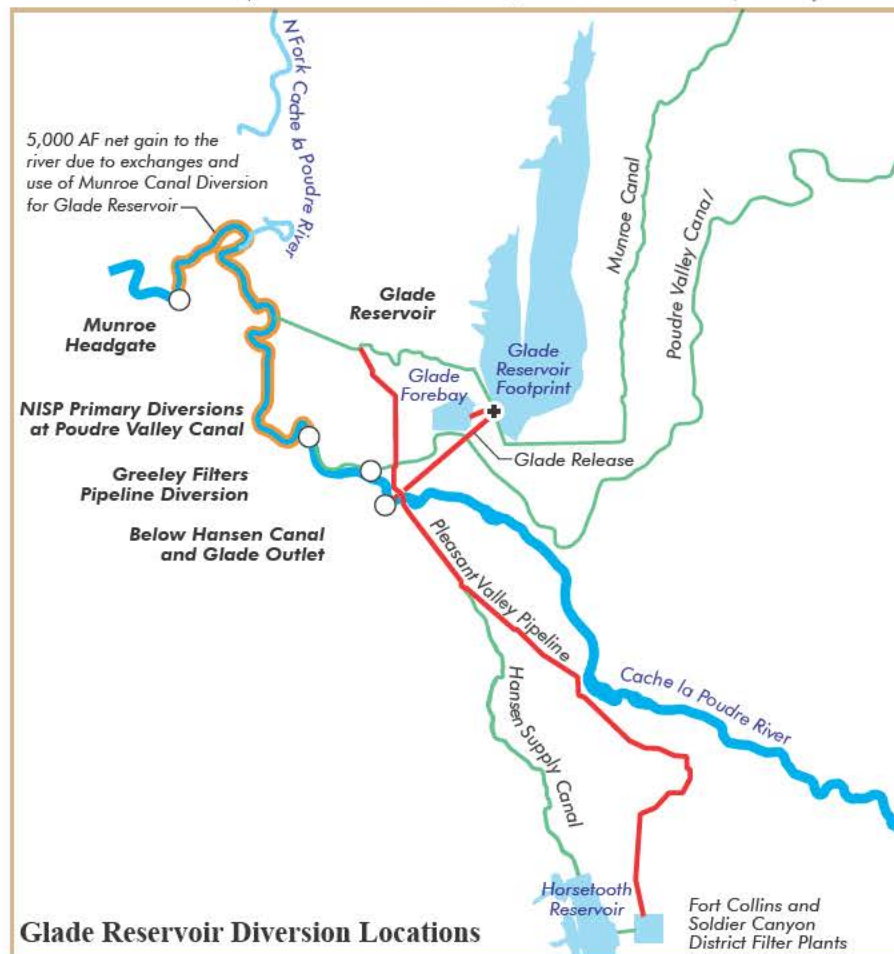
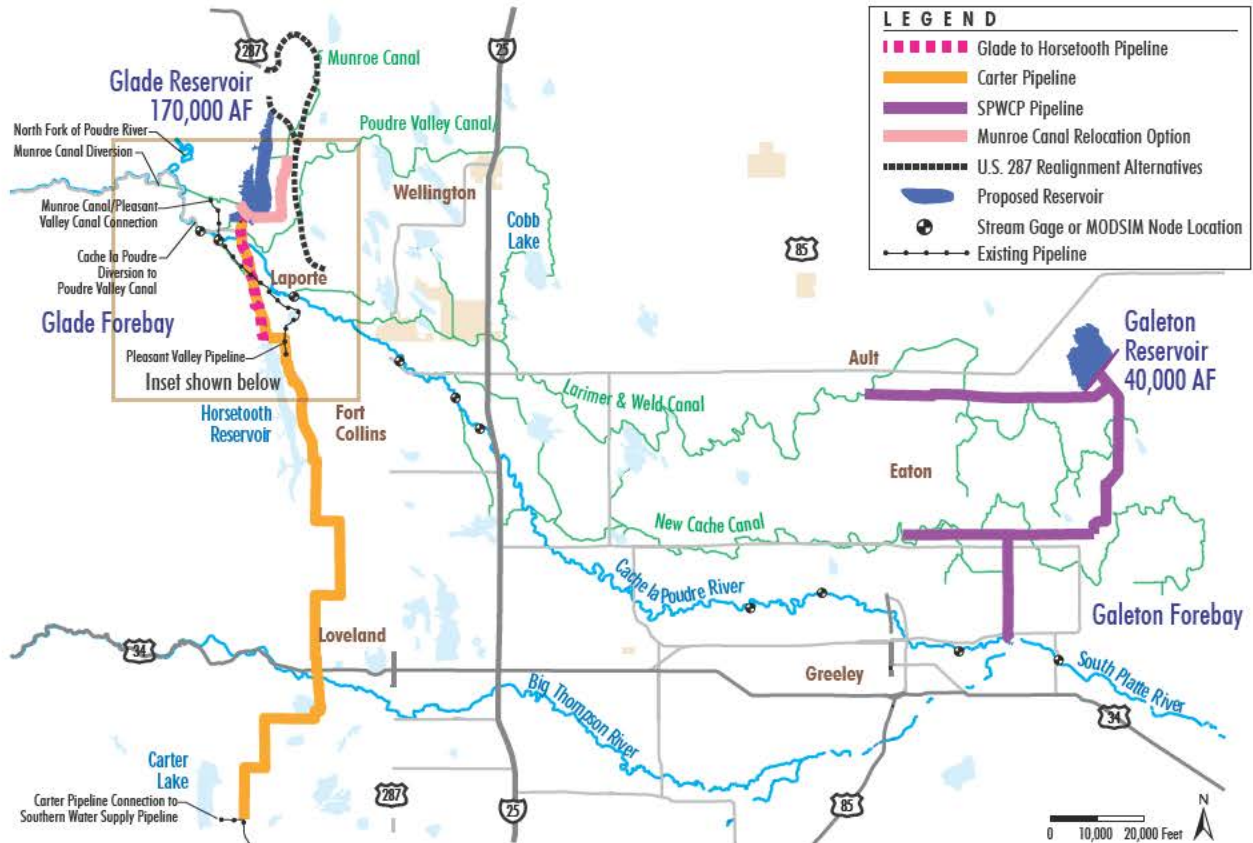
2.3.2 South Platte Water Conservation Project

The SPWCP is a component of all three action alternatives. The SPWCP is the component that facilitates exchanges of water diverted from the South Platte River for water diverted from the Poudre River that would be delivered to the Participants. The SPWCP would include a proposed Galeton Reservoir with a capacity of about 40,000 AF for Alternatives 2 and 3, and 20,000 AF for Alternative 4. Construction of the proposed Galeton Reservoir would include a diversion structure on the South Platte River, a forebay, pump station, and pipelines to deliver water diverted from the South Platte River to Galeton Reservoir and ditch systems for exchange. The SPWCP would be operated to deliver water stored in Galeton Reservoir or diverted from the South Platte River to the New Cache Canal and Larimer-Weld Canal in exchange for water diverted from the Poudre River that would be delivered to the Participants.

2.3.3 Deliveries to the Southern Participants

The NISP southern Participants are Lafayette, Erie, Lefthand Water District (LHWD), Fort Lupton, Central Weld County Water District (CWCWD), Fort Morgan, and the Morgan County Quality Water District (MCQWD). Collectively, these Participants require the delivery of 29,500 AF of firm yield each year. Different facilities and delivery routes are required depending on whether the project raw water supply is stored in the proposed Glade Reservoir (Alternative 2 and Subalternative 4.1) or the

Figure 2-2. Alternative 2—Proposed Action.



proposed Cactus Hill Reservoir (Alternative 3 and Subalternative 4.2). For each alternative, there is a Bureau of Reclamation (Reclamation) Contract Subalternative and a Reclamation No Contract Subalternative.

2.3.3.1 Reclamation Contract Subalternative

For deliveries from Glade Reservoir, the Reclamation Contract Subalternative would include an exchange and/or storage contract between the Applicant (NCWCD or District) and Reclamation, as well as a pipeline connection from Glade Reservoir to Horsetooth Reservoir (to be built only if necessary). The proposed exchange involves the annual delivery of 29,500 AF from Carter Lake to the NISP southern Participants, with equivalent replacement water to be released (1) from Glade Reservoir directly to the Poudre River to meet C-BT irrigation needs, (2) directly from Glade Reservoir into the Munroe Canal, or (3) delivered by pipeline to Horsetooth Reservoir. The Glade Reservoir outlet is proposed to be located across the Poudre River or a short distance above the existing Hansen Canal outlet in order to avoid dewatering effects downstream.

There are two options for delivering water from Cactus Hill under the Reclamation Contract Subalternative. The first option includes the construction of a new spillway into Horsetooth Reservoir near the Soldier Canyon Dam. The full 29,500 AF of exchange replacement water would be delivered to this point through a pipeline from Cactus Hill Reservoir.

The second option is similar to the first, but the volume delivered by pipeline to Horsetooth Reservoir would be reduced, and additional delivery points would be constructed where the pipeline intersects the Larimer County Canal and the Poudre River. The capacity to exchange C-BT water with

the Larimer County Canal is limited; as of 2005, the Water Supply and Storage Company (WSSC) owned only 3,824 C-BT units, which have an average yield of 2,677 AF (based on the 0.7 AF/unit average quota). Therefore, the bulk of the exchange deliveries would have to be made by direct releases to the Poudre River or into Horsetooth Reservoir. The intersection of the proposed Cactus Hill to Horsetooth pipeline (shown in Figure 2-3) is about 7 miles downstream from the existing Hansen Canal outlet.

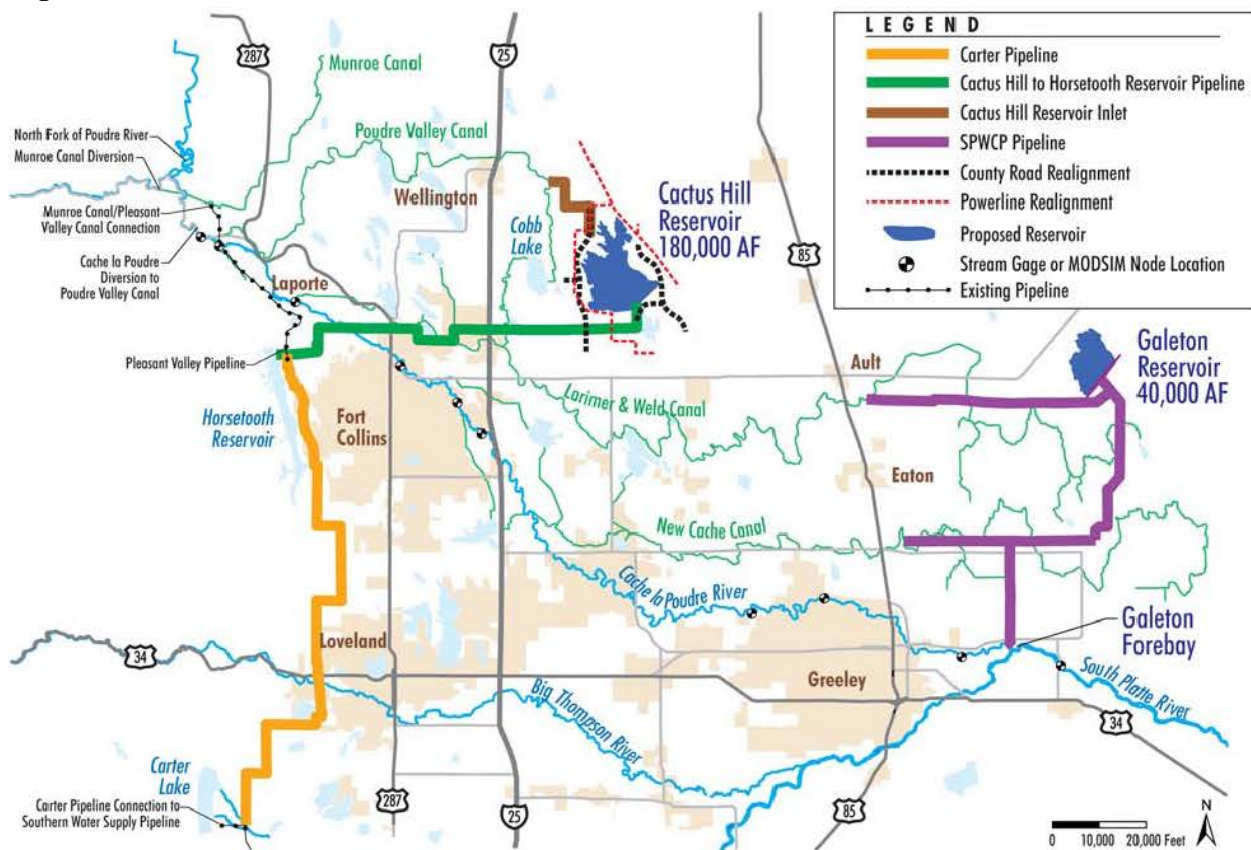
2.3.3.2 Reclamation No Contract Subalternative

For deliveries from Glade Reservoir, the Reclamation No Contract Subalternative would include the construction of a pipeline to the south (the proposed Carter pipeline) to connect Glade Reservoir to the existing Southern Water Supply Project (SWSP). This would not require an exchange or storage contract between the Applicant and Reclamation or a connection to Horsetooth Reservoir (i.e., there would be no discretionary action by Reclamation associated with this subalternative). The Carter pipeline is illustrated in Figure 2-3.

To make deliveries from Cactus Hill Reservoir, the Reclamation No Contract Subalternative includes the construction of a pipeline from Cactus Hill Reservoir to the vicinity of the Soldier Canyon Water Treatment Facility, where it would connect to a shorter version of the Carter pipeline (Figure 2-3).

The Reclamation No Contract Subalternative is distinct from the NISP No Action alternative.

Figure 2-3. Alternative 3—Cactus Hill Reservoir and the SPWCP.



2.3.4 Deliveries to the Northern Participants

The NISP northern Participants are the Fort Collins-Loveland Water District (FCLWD), Eaton, Windsor, Severance, and Evans. These Participants have a collective firm yield demand of 10,500 AF per year. Delivery mechanisms vary depending on whether the NISP primary storage facility is Glade Reservoir or Cactus Hill Reservoir. As explained above for the Reclamation Contract Subalternative, the impacts of exchanges for the purpose of delivering water from a NISP reservoir to the northern Participants are not quantified in the results derived from the Poudre Basin MODSIM (a modeling tool) networks.

2.3.4.1 Deliveries from Glade Reservoir

FCLWD, Eaton, Windsor, and Severance receive treated water from the Soldier Canyon Water Treatment Facility. About 8,900 AF/year would be diverted at the Munroe Canal and delivered to the Soldier Canyon Water Treatment Facility through the Pleasant Valley pipeline. To complete the delivery by exchange, 8,900 AF would be released from Glade Reservoir to the Poudre River near the existing Hansen Canal outlet.

Evans, which has a NISP firm yield demand of 1,600 AF, receives treated water from the City of Greeley. Through an exchange, water would be diverted at the Greeley Filters pipeline intake and replaced a short distance downstream by releases from Glade Reservoir.

2.3.4.2 Deliveries from Cactus Hill Reservoir

FCLWD, Eaton, Windsor, and Severance would receive water by direct deliveries from the Cactus Hill to Horsetooth pipeline into the Soldier Canyon Water Treatment Facility. Evans would receive its supply by exchange with water diverted at the

Greeley Filters pipeline intake and replaced by releases to the Poudre River near Laporte.

2.4 ALTERNATIVE 2— PROPOSED ACTION— GLADE RESERVOIR AND THE SPWCP

The District's Proposed Action is a proposed Glade Reservoir with a capacity of approximately 170,000 AF. Associated with Glade Reservoir would be a forebay, pump station, improvements to the Poudre Valley Canal and diversion to convey water diverted from existing diversions on the Cache la Poudre River to the proposed reservoir, and temporary access roads to be used during construction. Glade Reservoir would inundate about 7 miles of U.S. 287, which would require the relocation of the inundated segment of the highway. Additionally, Glade Reservoir would inundate a section of the Munroe Canal (aka, North Poudre Supply Canal); therefore, a portion of the canal also would need to be rerouted. Water from Glade Reservoir would be conveyed to Horsetooth Reservoir for distribution to the Participants. The SPWCP, with a 40,000 AF Galeton Reservoir, is included in Alternative 2. Galeton Reservoir is assumed to have a starting storage of 15,000 AF (Figure 2-2).

Water would be released from Glade Reservoir to the Poudre River near the Hansen Supply Canal delivery point, which delivers C-BT water from Horsetooth Reservoir to the Poudre River. To accomplish this, releases from Glade Reservoir would be made back into the forebay at the pump station. Water would be released into the Poudre Valley Canal from the forebay and would flow about 4,000 feet to near the location of the existing Pleasant Valley pipeline. A covered box section spillway would parallel the Pleasant Valley pipeline

south from SH 14 to the Poudre River (Figure 2-2). There would also be a small secondary outlet from the forebay to make low forebay level deliveries to the adjacent drainage of about 40 cfs to 50 cfs.

Two alternative alignments are being considered for the relocation of U.S. 287. Both alignments would travel through the abandoned Holcim limestone mine. The District's Proposed Action alignment would travel through the Holcim Mine for about 6 miles, then cut west through the hogback to meet the existing U.S. 287 alignment near the northern end of the proposed reservoir. The second alternative alignment would travel north to follow portions of the alignment of the Owl Canyon Road.

2.4.1 Operational Flexibility

The District has the following needs for operational flexibility for the Proposed Project:

- There would be two potential realignment options for rerouting the existing Munroe Canal around the proposed Glade Reservoir.
- The NISP Participants would have the ability to buy and sell their portion of NISP by contract.
- The District needs to have the ability to use sources of water other than the Grey Mountain water right for the initial fill of Glade Reservoir and during an emergency drought in the region as declared by the State of Colorado.
- The ability to use out-of-priority storage to fill Galeton Reservoir when situations allow.
- The option of diverting at a rate of up to 200 cfs for the SPWCP.
- The existing Poudre Valley Canal diversion would be the primary diversion from the Poudre River to fill the Proposed Glade Reservoir; however, in certain situations the existing Munroe Canal diversion would serve as a secondary diversion from the Poudre River.
- The ability to enter into dry-year leasing or interruptible supply contracts with agricultural irrigation users to meet project water needs

when drought conditions are worse than those evaluated by the NISP hydrology model.

2.4.1.1 *Realignment Options for the Munroe Canal*

The District would have two options for constructing the Munroe Canal bypass. The first option would involve putting the Munroe Canal in a pipe in the valley below the proposed Glade Reservoir dam, then tunneling the ridge to the east, and running a 72-inch pipeline up the adjacent valley. The system would flow by gravity up to 100 cfs. Above that flow, up to 250 cfs, pumps co-located in the planned Glade Reservoir pump station would add enough head to make the full canal capacity delivery. The capital costs for this option are slightly higher than the second option; however, when factoring in the present worth of operations and maintenance, the costs would be the same or slightly less.

The second option would require the construction of a turn-out/termination structure on the existing Munroe Canal west of Glade Reservoir to divert the 250 cfs flow from the existing open channel through a pipeline to the Poudre Valley Canal. An energy dissipation/stilling basin structure would be required at the Poudre Valley Canal to transition flow from the pipeline to the open channel Poudre Valley Canal. From this point, the total flow would be carried by the Poudre Valley Canal around the south and east sides of the proposed Glade Reservoir. The existing Poudre Valley Canal would require improvements and modifications to carry the proposed design flow adequately. East of Glade Reservoir, a turn-out structure in the Poudre Valley Canal and intake facilities would be required to divert up to 250 cfs from the Poudre Valley Canal to a pumping station facility, pipeline, and discharge structure necessary to lift the flow back up to the existing Munroe Canal and transition to the existing open channel configuration.

2.4.1.2 *Participants' Ability to Purchase and Sell Participation in NISP*

The NISP Participants would have the ability to sell their contract rights in NISP to other entities within the District boundaries or buy additional contract rights in NISP as they become available. The ability to purchase and sell contracts in NISP would not alter the size or operation of NISP. Once NISP becomes operational, it is anticipated that there would be a market for NISP contracts similar to the market that currently exists for C-BT units.

2.4.1.3 *Sources of Water for Initial Fill of Glade Reservoir*

The EIS evaluations of Glade Reservoir are based on a planned initial fill volume of approximately 100,000 AF at the time of project start-up. However, the anticipated sequence of NISP construction is to build the Glade Reservoir complex followed by the SPWCP. Until the SPWCP is online, Glade Reservoir will be wholly dependent on the Grey Mountain water right. This water right has the capability of yielding water in about 4 out of 10 years. Modeling indicates that there can be several years in a row of divertible flow followed by as many as 8 years with no flow available. Therefore, it is possible that divertible flows from the Poudre River may not be available under the Grey Mountain water right to fill Glade Reservoir at the start of NISP. The Participants could choose to wait to fill Glade Reservoir until divertible flows became available under the Grey Mountain water right or find other interim sources of water to fill Glade Reservoir.

At the time of project start-up, NISP Participants will need approximately 10,000 to 15,000 AF of yield. If water is not available from the Grey Mountain water right, then other water sources could be considered by NISP Participants as interim supplies. It is assumed that these sources would

already be decreed for municipal use or have an approved substitute water supply plan, thereby eliminating the temporary transfer of native agricultural water rights. The following sources would likely serve as an alternate source of supply if water was not available from the Grey Mountain water right at project start-up (NCWCD 2007):

- **C-BT units**—C-BT units could be rented by NISP Participants. There is presently a very active rental market of C-BT water, generally from municipal to agricultural use. NISP Participants could either collectively or separately rent C-BT water. If the rented C-BT water is greater than the Participant's need in that year, the water could be delivered into Glade Reservoir. The water would be delivered to the Project from Horsetooth Reservoir through the Windsor Extension into the Poudre Valley Canal.
- **Windy Gap**—Windy Gap water could be rented by NISP Participants. NISP Participants can either collectively or separately rent Windy Gap water from Windy Gap Participants. If the rented Windy Gap water is greater than the Participant's need in that year, the water could be delivered into Glade Reservoir. The water would be delivered to the Project from Horsetooth Reservoir through the Windsor Extension into the Poudre Valley Canal.
- **Grand River Ditch**—The Grand River Ditch diverts water from the Colorado River drainage for the use by Water Supply and Storage Company (WSSC). These diversions average approximately 18,000 AF per year. WSSC serves an area roughly parallel to State Highway 14 from northeast of Fort Collins to several miles past the Town of Ault via the Larimer County Ditch. Because the water is trans-mountain, no return flow obligations are necessary and the water can be rented directly from WSSC shareholders. The water is presently diverted at the Larimer County Canal headgate above Laporte, and would be diverted for the Project at the Poudre Valley Canal.

- Tunnel Water Company—The Laramie-Poudre Tunnel diverts water from the Laramie River drainage for use by both WSSC (two-thirds) and the Windsor Reservoir and Canal Company (one-third). Windsor Reservoir and Canal Company diversions are generally made at the Larimer and Weld Canal. Diversions average approximately 16,000 AF per year. Because the water is transmountain, no return flow obligations are necessary and the water can be rented directly from WSSC and/or the Windsor Reservoir and Canal Company shareholders. This water would be diverted from the Project at the Poudre Valley Canal.

The rental of these supplies could provide enough water to begin NISP operations. C-BT and Windy Gap water would only be put into Glade Reservoir if the amount rented by the Participants was greater than the amount that could be used in a given year. Grand River Ditch and Tunnel Water Company water would be first exchanged with C-BT water if exchange potential was available at the time. If exchange could not be made directly, then the water would be diverted into Glade Reservoir.

2.4.1.4 Sources of Water for Drought Conditions

The NISP configuration was sized based on 1950 through 1999 hydrology. This 50-year period has had a number of droughts, including the 1950s. The project is not sized, however, to accommodate droughts more severe than the 1950s. For example, the most recent drought (2000–2006) was more severe than those experienced during the modeled period. From 2000 to 2006, the Grey Mountain water rights have not been in priority, and the historically more frequently yielding SPWCP water rights have rarely been in priority. In such severe drought events, it is expected that NISP Participants, while curtailing their demands, would still require water supplies. Additionally, because of the conservative nature of municipal water supply

planning, it is unlikely that Participants would be willing to fully draw down their supplies in Glade Reservoir in the hopes that supplies will be available the following year.

The District desires the ability to provide water to NISP in years when the annual divertible flows from the Poudre River fall below 20,000 AF. These low flows are lower than the 1953 to 1956 drought of record of 20,200 AF, which represents about a 1-in-50 year drought evaluated by the NISP hydrology model (Brouwer, pers. comm. 2008). When the 3-year running average of diversions into Glade Reservoir from NISP water rights, either directly or by exchange, drops to 20,000 AF/year, or 60,000 AF in a sequential 3-year period, or lower, NISP will have the option of entering into contracts with agricultural water users to lease water that can be subsequently diverted and stored in NISP facilities. The irrigation water may be exchanged directly into Glade Reservoir if it is derived from the Poudre River, or may be pumped into the SPWCP from irrigators diverting from the South Platte River. The likely ditch companies to be used by NISP for this purpose would include WSSC, Larimer and Weld, and New Cache. The amount anticipated for temporary transfer would not exceed the amount of water typically exchanged from the SPWCP (24,500 AF) during a dry year (HDR 2007a), and the effects of the diversions on streamflows would be similar to the effects modeled for the action alternatives for normal operations. Any such short-term diversions will be in compliance with Colorado law and subject to administration by the Colorado State Engineer's Office. At all times, the minimum required flows on the Poudre River will be maintained.

2.4.1.5 Out-of-Priority Storage for Galetan Reservoir

Out-of-priority storage is when a junior diverter, such as the SPWCP, diverts a senior downstream

reservoir's water right during the winter to spring fill season. This practice is allowed by the State Engineer's Office. In years when the runoff is sufficient for senior diverters to fill later in the season, the out-of-priority fill of Galeton Reservoir would hold and there would be no harm to downstream senior diverters. In years in which runoff is insufficient for senior diverters to fill, the out-of-priority storage would be required to be released back to the South Platte River. The planned operation for the SPWCP would be to typically divert during the winter. Any out-of-priority diversions by the SPWCP would be consistent with the hydrologic modeling for NISP.

2.4.1.6 Diversions of up to 200 cfs for the SPWCP

The District would need the flexibility to divert at a rate of up to 200 cfs from the South Platte River for the SPWCP (Figure 2-2). The SPWCP is currently designed to divert at a rate of up to 150 cfs. The increased rate of diversion would provide the needed operational flexibility should the current season for SPWCP diversions shorten in the future.

2.4.1.7 Use of the Munroe Canal Diversion.

The District has listed three potential points of diversion in its application to the State Water Court: Poudre Valley Canal, Munroe Canal, and the dam site associated with Grey Mountain water rights. The District proposes to use the existing Poudre Valley Canal and Munroe Canal diversions for Glade Reservoir. The Poudre Valley Canal would be the primary intake for Glade Reservoir. Use of these existing diversion and intake structures for NISP would require upgrading the structures.

The Munroe Canal diversion (also known as the North Poudre Supply Canal) would potentially be used as a secondary point of diversion for Glade Reservoir to supply water to NISP Participants

associated with the Pleasant Valley pipeline. During the late summer months the Munroe Canal diversion would be used to fill Glade Reservoir when water quality in the North Fork of the Poudre River is of lesser quality than the mainstem of the Poudre River upstream of the confluence with the North Fork. The Munroe Canal diversion occurs on the mainstem of the Poudre River upstream of the confluence of the North Fork of the Poudre River and would therefore divert water about 5 miles higher on the Poudre River than the Poudre Valley Canal (Figure 2-2).

The effect of using the Munroe Canal as an alternate diversion is that C-BT water that would otherwise have been diverted at the Munroe Canal headgate could be delivered from Glade Reservoir. That portion of the river reach between the Munroe Canal headgate and the Horsetooth Reservoir delivery point into the Poudre River (Charles Hansen Supply Canal) would then have more water, compared to the baseline condition. With Glade Reservoir, there would be a physical capability of delivering water from the reservoir into the Munroe Canal near the Glade dam site, and the NPIC Munroe Canal C-BT deliveries could be made by exchange directly from Glade Reservoir. However, if the C-BT delivery were made via Glade Reservoir, the water that would have been diverted at the Munroe Canal by NPIC would stay in the river for a net gain to that particular river reach. It is estimated that about 15,000 AF of C-BT diversions by NPIC at the Munroe Canal could be replaced with NISP water at the Glade Reservoir delivery point across from the Hansen Supply Canal. If the 10,000 AF of NISP water were diverted at the Munroe Canal for the northern Participants associated with the Pleasant Valley pipeline, there could be a net gain of about 5,000 AF to about 5 miles of the Poudre River between the Munroe Canal and the Charles Hansen Supply Canal (Hansen Canal) as long as sufficient

supplies of C-BT continue to be diverted at the Munroe Canal.

2.5 ALTERNATIVE 3—CACTUS HILL RESERVOIR AND THE SPWCP

Alternative 3 is similar to the District's Proposed Action except that water diverted from the Poudre River would be stored in the proposed Cactus Hill Reservoir instead of the proposed Glade Reservoir. Cactus Hill Reservoir would have a capacity of approximately 180,000 AF, with an anticipated initial fill volume of 120,000 AF at project start-up. Alternative 3 includes the SPWCP with a 40,000 AF Galeton Reservoir. The Poudre Valley Canal would convey water diverted from the Poudre River to Cactus Hill Reservoir. Construction of Cactus Hill Reservoir would include improvements to the Poudre Valley Canal and intake headgate and construction of temporary access roads. Construction would necessitate realignment of three Weld County Roads and two power lines owned and operated by the Platte River Power Authority. Water from Cactus Hill Reservoir would be conveyed via a pipeline to Horsetooth Reservoir for distribution to the Participants. The Cactus Hill and SPWCP alternative is shown in Figure 2-3.

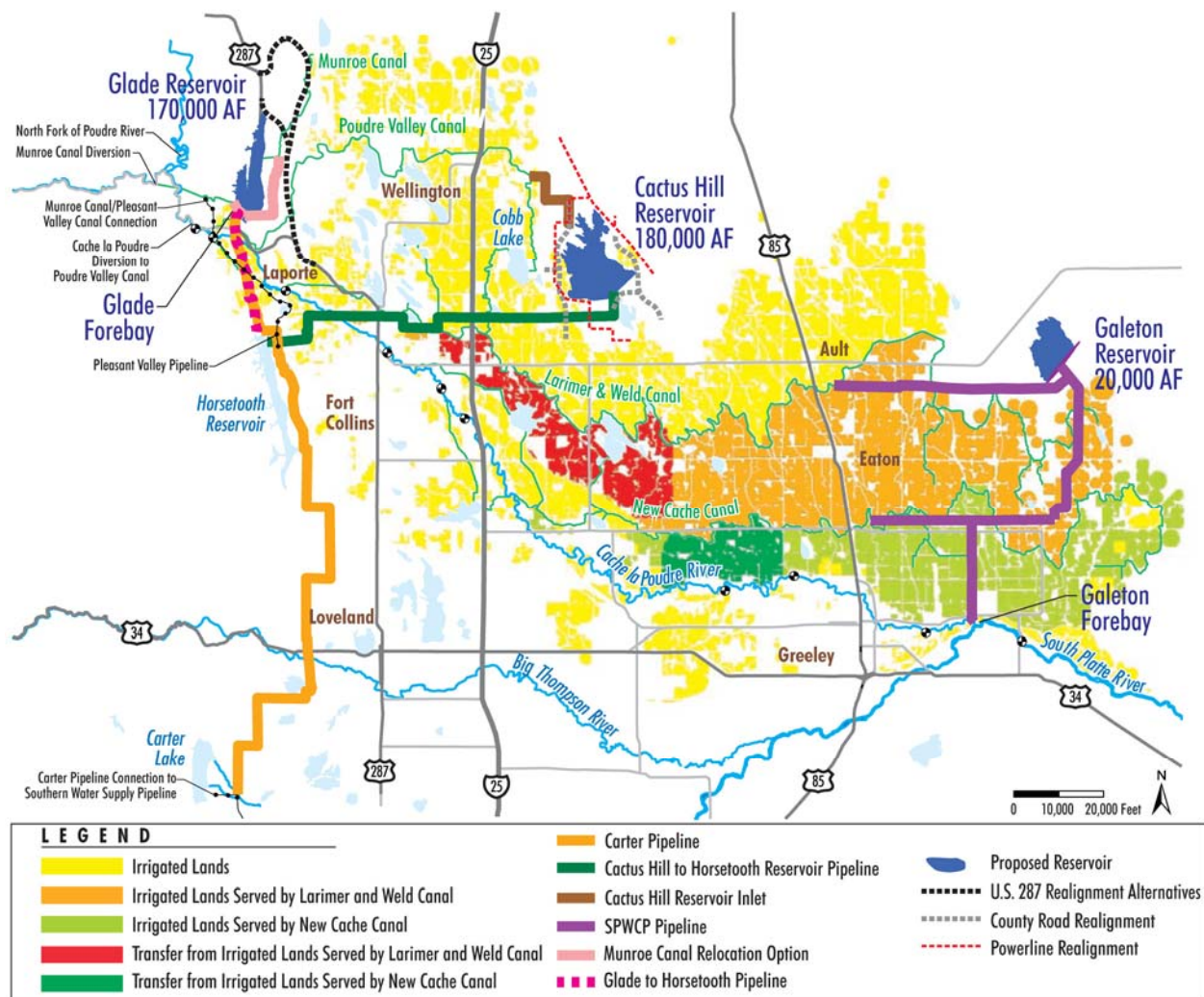
2.6 ALTERNATIVE 4—GLADE RESERVOIR AND SPWCP WITH AGRICULTURAL TRANSFERS

Alternative 4 is similar to the District's Proposed Action (Figure 2-4) except that about 12,000 AF of the Participants' requested yield would come from the purchase and transfer of agricultural water rights to M&I use (Figure 2-4). This alternative likely

would reduce the amount of water that would need to be diverted from the South Platte River through the SPWCP when compared to the Proposed Action. The size of the proposed Glade Reservoir under the Alternative 4 would be 170,000 AF (the same size as proposed under the Proposed Action), and Galeton Reservoir would be constructed to store 20,000 AF of water to reflect the contribution of the transferred water (a reduction of 20,000 AF relative to the Applicant's Proposed Action). Reduced use of the Grey Mountain water right with a 40,000 AF Galeton Reservoir were also evaluated, but were determined not to be practicable (HDR 2007a).

For the purposes of evaluation in the EIS, a scenario was developed that involves the transfer of agricultural water from the Larimer-Weld and New Cache canals to obtain 12,000 AF of new firm yield. Prorationing described in the Addendum to Appendix E results in approximately 7,400 AF (62 percent) of consumptive use (CU) water being transferred from the Larimer-Weld Canal and roughly 4,600 AF (38 percent) from the New Cache Canal. It is estimated that approximately 21,500 AF of agricultural water rights associated with about 17,150 acres of irrigated land would have to be purchased by NISP to produce the 12,000 AF of transferable CU water. Figure 2-4 shows one example of agricultural lands that could be involved in this scenario. Under this scenario, other irrigated lands served by the Larimer-Weld and New Cache canals could be subject to the transfer of agricultural water rights to M&I use. Other scenarios could be developed that would involve other canals and other irrigated lands in the region.

Figure 2-4. Potential Agricultural Transfer Lands (Portion of Alternative 4).



Cactus Hill Reservoir Subalternative 4.2. This subalternative would involve construction of a 180,000 AF Cactus Hill Reservoir rather than Glade Reservoir (Figure 2-4). All other aspects of this alternative would remain the same as described for Alternative 4.

2.7 RELATED FEDERAL AGENCY ACTIONS

As discussed in Chapter 1, the Corps is the lead federal agency for the NISP EIS and the Corps'

decision to issue or deny a Section 404 permit for the project is a major federal action. Reclamation has discretionary federal actions that are related to the Corps' federal action. These related federal agency actions are described below.

2.7.1 Bureau of Reclamation

All of the action alternatives propose to use some East Slope C-BT Project facilities to distribute NISP water to the Participants. Most C-BT facilities are owned by the United States and operated by

Reclamation in coordination with the District (see Section 1.1.1 for a description of the C-BT facilities). Use of the C-BT facilities would require approvals from Reclamation and are related federal actions to the action alternatives. Reclamation is a cooperating agency responsible for addressing Reclamation's related actions and ensuring that the NISP EIS addresses Reclamation's NEPA requirements.

The Applicant's Proposed Action proposes to deliver water to the Participants by exchange using Horsetooth Reservoir and Carter Lake, which are C-BT facilities. As proposed, NISP water stored in Glade Reservoir would be used to meet some requests for C-BT water from Horsetooth Reservoir and Carter Lake, and these deliveries of NISP water from Glade Reservoir would be exchanged for a like amount of water to be delivered to the Participants from Horsetooth Reservoir or Carter Lake. The Applicant's Proposed Action also proposes to construct a pipeline between Glade Reservoir and Horsetooth Reservoir. The District anticipates that the proposed Glade to Horsetooth pipeline would not need to be constructed as long as there is sufficient C-BT exchange potential in the Poudre Basin to implement the exchanges. The anticipated future conversion of C-BT units from agricultural uses to M&I uses will limit the C-BT exchange potential in the Poudre Basin in the future and may require the future construction of the Glade to Horsetooth pipeline.

Reclamation's discretionary federal actions involve entering into a contract with the District for storage and/or exchange of NISP water in C-BT facilities and issuance of a special use permit that would authorize the connection of the pipeline from Glade Reservoir to Horsetooth Reservoir.

Prior to entering into any storage or exchange contract with the District, Reclamation would

determine all potential impacts to the C-BT Project, its operation and users, and the NISP EIS will evaluate and disclose any such impacts. Following the release of the Draft EIS for public review and comment, Reclamation will enter into contract negotiations with the District. The negotiations, and ultimately the contract and contract conditions, will address the effects of NISP connections, exchanges and/or storage on C-BT facilities, operations, and users.

Following the completion of the EIS, Reclamation will prepare a ROD that will address Reclamation's discretionary actions and the agency's decisions regarding these actions.

2.7.2 Colorado Department of Transportation

The Applicant's Proposed Action includes realignment of a portion of U.S. 287 at the proposed Glade Reservoir site. CDOT is a state cooperating agency for the EIS and is responsible for evaluating the proposed realignment of U.S. 287. CDOT is responsible for ensuring that the NISP EIS addresses CDOT's NEPA requirements. As a cooperating agency, CDOT will be responsible for selection of alternative alignments, analysis of impacts associated with the proposed alternative alignments, and public involvement related to the proposed realignment of U.S. 287.

The evaluation of the proposed realignment of U.S. 287 is addressed as a subalternative under the Applicant's Proposed Action throughout the EIS. A decision on permitting a water supply project for the Participants will be made by the Corps. Decisions regarding the realignment of U.S. 287 will be made jointly by CDOT and the Corps.

A purpose and need statement was developed to assist the EIS team in its evaluation of alternatives

for the proposed realignment of U.S. 287. The following purpose and need statement does not affect or relate to the overall NISP purpose and need for a reliable firm water supply for the Participants (Chapter 1) and is intended only for the proposed realignment of U.S. 287.

The purpose of this portion of the Applicant's preferred water supply alternative is to relocate U.S. 287, resulting in a roadway that is similar in nature to the existing highway, which will safely accommodate current and future traffic levels while maintaining current connectivity. Definitions of phrases used in the U.S. 287 realignment purpose and need statement include:

- Relocate — provide a highway with similar horizontal and vertical criteria.
- Similar in nature — similar horizontal and vertical design standards, roadway cross section, future expansion capabilities, right of way access, and maintenance issues.
- Safely accommodate — maintain existing level of service, roadside safety issues, intersections (points of conflict), safe pass zones; ability to expand to maintain level of service and safety.
- Connectivity — maintain the continuity of U.S. 287 from north of Fort Collins to the Wyoming state line.

Following the development of the purpose and need statement for the proposed realignment of U.S. 287, CDOT evaluated 14 potential alignments in Level 1 screening of the alternatives evaluation process (HDR 2005a). The preliminary alternatives varied from alignments in the vicinity (east and west) of proposed Glade Reservoir to Taft Hill Road-21 Road (Figure 2-5). At the conclusion of Level 1 screening of the U.S. 287 alignment alternatives, the alternatives were presented to the public at a public open house. Based in part on comments received at the public open house, some of the alignments were

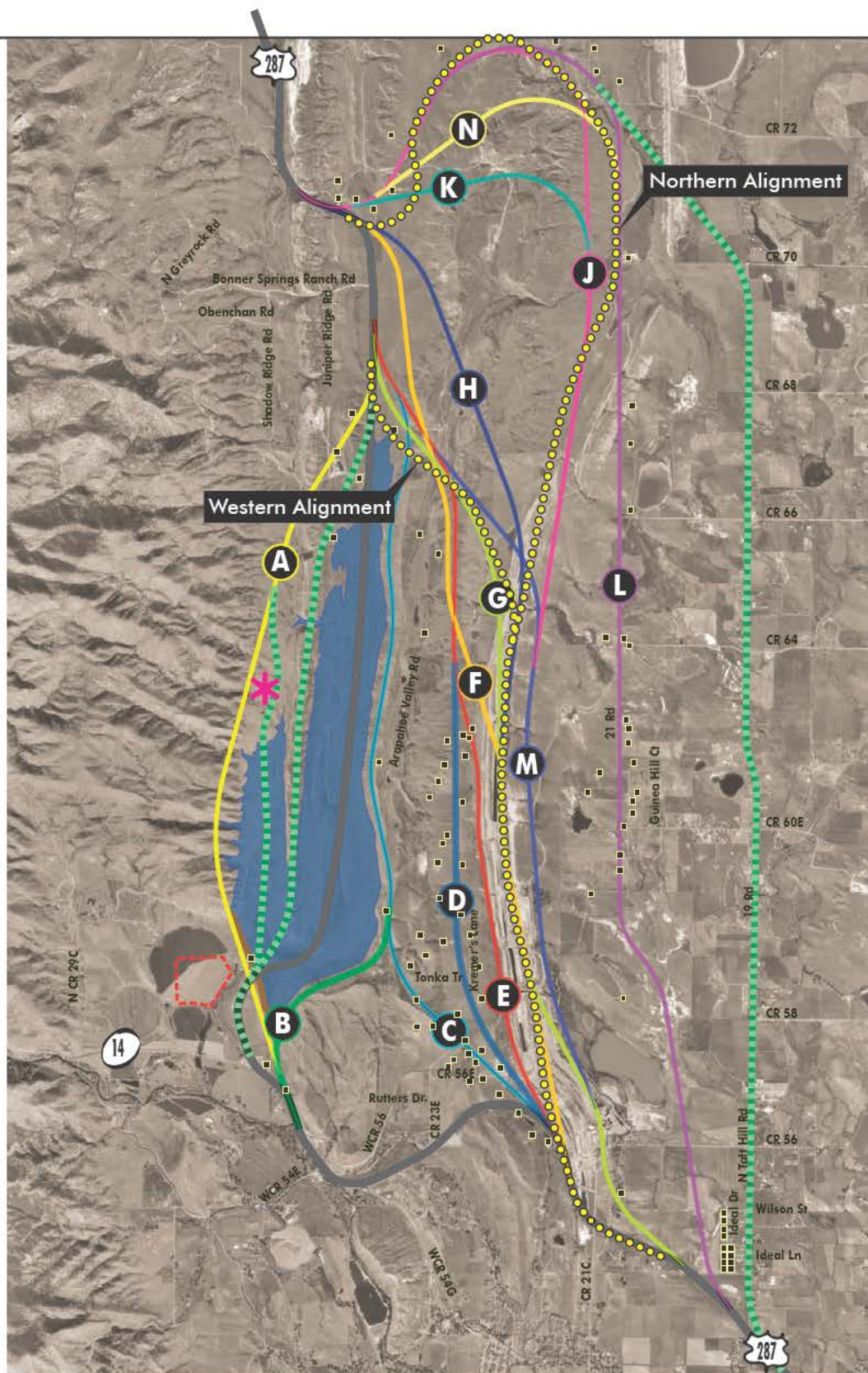
combined for Level 2 screening because they were similar.

From the approximate common southern termini of the alignments to the approximate extension of County Road (CR) 66, four separate and distinct alignments were identified. From CR 66 north, three alignments turned west and crossed over the hogbacks, while a single alignment, Alternative J, continued on to the north.

Preliminary horizontal and vertical alignments were developed and a standard two-lane rural typical section was used to establish limits of construction and earthwork quantities. Using available mapping, impacts to houses, wetlands and riparian areas, upland vegetation, disturbed uplands, and total area of the alignment were computed for Level 2 screening.

Alignment E was eliminated from further consideration because it had the greatest potential for impacts to existing structures including direct impacts to at least two private residences. Alignment E also had the greatest amount of excess fill and would have required importing a substantial amount of embankment material. Alignment M was eliminated from further consideration because it had the greatest potential to impact wetlands and riparian areas.

Based on Level 2 screening, two alternative alignments—Alternative J, the northern alignment and Alternative F/G, the western alignment—were carried forward for evaluation in the EIS (Figure 2-6). These two alignments provide a reasonable range of alternatives that meet the purpose and need



- Conceptual alternatives, approximate route
- - - Considered but not evaluated
- Proposed Glade Reservoir
- - - Proposed Forebay
- Houses/structures within 1000' of alternative

* Note: Two alignments were considered in the western portion of the reservoir. These would be feasible if a smaller reservoir were constructed.

Figure 2-5
Preliminary Alternative
Alignments for Level 1
Screening for U.S. 287

Prepared for: U.S. Army Corps of Engineers
File: Figure 2-5.pdf
November 2007

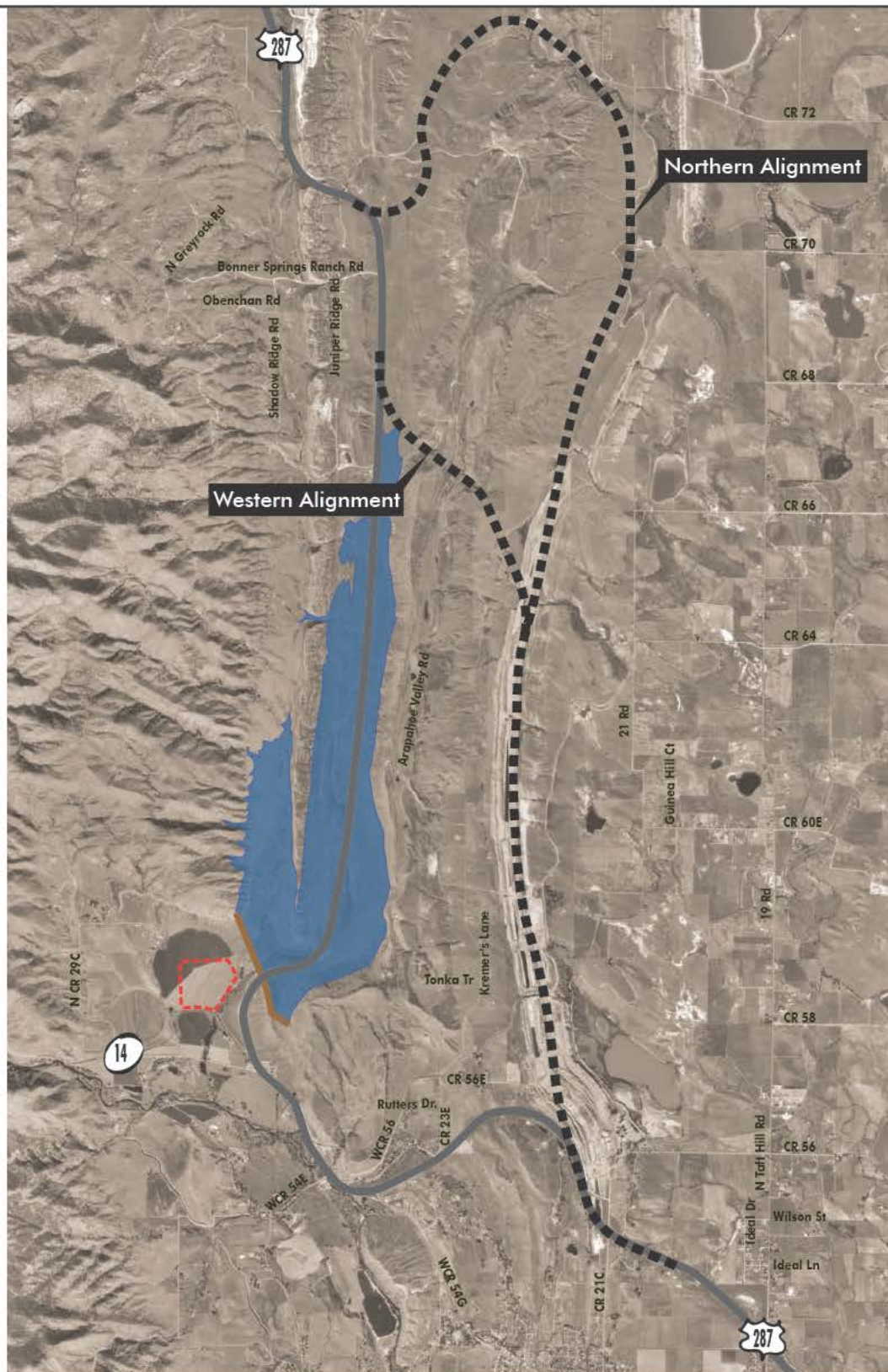


Prepared by:

ERO

0 2,000 4,000
feet
Aerial Photo: USGS 10/4/1999





■■■■■ Conceptual alternatives, approximate route

■ Proposed Glade Reservoir

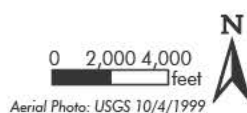
■■■■■ Proposed Forebay

Figure 2-6
U.S. 287 Realignment
Alternatives

Prepared for: U.S. Army Corps of Engineers
File: Figure 2-6.pdf
April 2007



Prepared by:
ERO



for the realignment (HDR 2005b). Subsequent to Level 2 screening, the northern alignment was refined to meet CDOT design criteria and further reduce impacts to wetlands and waters of the U.S. (Muller 2006a). The District has not selected a preferred alignment alternative.

2.8 SUMMARY

2.8.1 Comparison of Alternative Features

Table 2-4 provides a summary comparing the major features associated with the action alternatives.

2.8.2 Comparison of Alternative Costs

Table 2-5 and Table 2-6 provide the estimated costs of the alternatives. The No Action alternative has the highest estimated total capital cost (\$830,500,000) and the Proposed Action has the lowest estimated total capital cost (\$426,000,000).

Table 2-4. Comparison of Features for Each Alternative.

Feature	Alternative 2—Glade plus SPWCP and Galeton (Proposed Action)				Alternative 3—Cactus Hill plus SPWCP and Galeton		Subalternative 4.1—Glade plus SPWCP and Galeton plus Ag. Transfers				Subalternative 4.2—Cactus Hill plus SPWCP and Galeton plus Ag Transfers	
	Reclamation Contract		Reclamation No Contract		Reclamation Contract	Reclamation No Contract	Reclamation Contract		Reclamation No Contract		Reclamation Contract	Reclamation No Contract
	U.S. 287 Western	U.S. 287 Northern	U.S. 287 Western	U.S. 287 Northern			U.S. 287 Western	U.S. 287 Northern	U.S. 287 Western	U.S. 287 Northern		
Storage and Facilities												
Glade or Cactus Hill Reservoir storage capacity	170,000 AF - 180,000 AF				180,000 AF - 200,000 AF		170,000 AF - 180,000 AF				180,000 AF - 200,000 AF	
Glade Reservoir and forebay or Cactus Hill Reservoir footprint ¹	1,917.73 acres				4,384.45 acres		Same as Alternative 2				Same as Alternative 3	
Galeton Reservoir storage capacity	40,000 AF				40,000 AF		20,000 AF				20,000 AF	
Galeton Reservoir footprint ²	1,827.24 acres				1,827.24 acres		1,239.60 acres				1,239.60 acres	
SPWCP forebay and facilities	21.47 acres				21.47 acres		21.47 acres				21.47 acres	
Facilities associated with pipelines	0.16 acre		1.00 acre		1.00 acre	2.00 acres	0.16 acre		1.00 acre		1.00 acre	2.00 acres
Borrow areas (temporary impacts)	61.18 acres for Glade				0 acre		61.18 acres for Glade				0 acre	
Pump stations along pipelines	1.00 acre for SPWCP pump stations				1.00 acre for SPWCP pump stations		1.00 acre for SPWCP pump stations				1.00 acre for SPWCP pump stations	

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES
NORTHERN INTEGRATED SUPPLY PROJECT EIS

Feature	Alternative 2—Glade plus SPWCP and Galetón (Proposed Action)				Alternative 3—Cactus Hill plus SPWCP and Galetón		Subalternative 4.1—Glade plus SPWCP and Galetón plus Ag. Transfers				Subalternative 4.2—Cactus Hill plus SPWCP and Galetón plus Ag Transfers	
	Reclamation Contract		Reclamation No Contract		Reclamation Contract	Reclamation No Contract	Reclamation Contract		Reclamation No Contract		Reclamation Contract	Reclamation No Contract
	U.S. 287 Western	U.S. 287 Northern	U.S. 287 Western	U.S. 287 Northern			U.S. 287 Western	U.S. 287 Northern	U.S. 287 Western	U.S. 287 Northern		
Roads												
Access roads (temporary impacts)	1.28 acres at Galetón forebay 26.48 acres at Galetón Reservoir 5.41 acres at Glade Reservoir 0.3 mile at Galetón forebay 2.6 miles at Galetón Reservoir 1.0 mile at Glade Reservoir				1.28 acres at Galetón forebay 26.48 acres at Galetón Reservoir 8.04 acres at Cactus Hill 0.3 mile at Galetón forebay 2.6 miles at Galetón Reservoir 0.7 mile at Cactus Hill		1.28 acres at Galetón forebay 26.48 acres at Galetón Reservoir 5.41 acres at Glade Reservoir 0.3 mile at Galetón forebay 2.6 miles at Galetón Reservoir 1.0 mile at Glade Reservoir				1.28 acres at Galetón forebay 26.48 acres at Galetón Reservoir 8.04 acres at Cactus Hill 0.3 mile at Galetón forebay 2.6 miles at Galetón Reservoir 0.7 mile at Cactus Hill	
County Road realignment	0 miles				9.9 miles 144.32 acres		0 miles				9.9 miles 144.32 acres	
U.S. 287 realignment	7.87 miles 144.47 acres	12.80 miles 164.85 acres	7.87 miles 144.47 acres	12.80 miles 164.85 acres	0 miles	0 miles	7.87 miles 144.47 acres	12.80 miles 164.85 acres	7.87 miles 144.47 acres	12.80 miles 164.85 acres	0 miles	0 miles
Total Alternative Permanently Impacted Area (temporary impacts not shown)	3,973.25 acres	3,993.63 acres	3,974.09 acres	3,994.47 acres	6,379.48 acres	6,380.48 acres	3,385.61 acres	3,405.99 acres	3,386.45 acres	3,406.83 acres	5,791.84 acres	5,792.84 acres

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES
NORTHERN INTEGRATED SUPPLY PROJECT EIS

Feature	Alternative 2—Glade plus SPWCP and Galeton (Proposed Action)				Alternative 3—Cactus Hill plus SPWCP and Galeton		Subalternative 4.1—Glade plus SPWCP and Galeton plus Ag. Transfers				Subalternative 4.2—Cactus Hill plus SPWCP and Galeton plus Ag Transfers	
	Reclamation Contract		Reclamation No Contract		Reclamation Contract	Reclamation No Contract	Reclamation Contract		Reclamation No Contract		Reclamation Contract	Reclamation No Contract
	U.S. 287 Western	U.S. 287 Northern	U.S. 287 Western	U.S. 287 Northern			U.S. 287 Western	U.S. 287 Northern	U.S. 287 Western	U.S. 287 Northern		
Conveyance												
SPWCP ³	31.1 miles		31.1 miles		31.1 miles	31.1 miles	31.1 miles	31.1 miles	31.1 miles	31.1 miles	31.1 miles	
Glade to Horsetooth Pipeline ³	5.50 miles						5.50 miles					
Glade to Carter Pipeline ³			31.09 miles					31.09 miles				
Cactus Hill Inlet and Cactus Hill to Horsetooth Pipeline ³					3.85 miles for Inlet 17.63 miles to Horsetooth				3.85 miles for Inlet 17.63 miles to Horse- tooth			
Cactus Hill Inlet and Cactus Hill to Carter Pipeline ³						3.85 miles for Inlet 41.89 miles for connection to SWSP					3.85 miles for Inlet 41.89 miles for connection to SWSP	
Total Conveyance Distance	36.6 miles		62.19 miles		52.58 miles	76.84 miles	36.6 miles	62.19 miles	52.58 miles		76.84 miles	

¹Includes spillway, forebay, associated facilities, and dam.

²Includes South Platte River diversion, forebay, and dam.

³Includes pipelines and pump stations.

Table 2-5. NISP No Action Estimated Costs.

NISP Participants/Group	Firm Yield Demand	Ag. Water Rights		Gravel Pit Storage		C-BT Purchases		New Wells/Enhanced Treat		Total Dollars	Cost per AF
		Volume	Dollars	Volume	Dollars	Volume	Dollars	Volume (MGD) ¹	Dollars ¹		
Unit Cost Assumption		\$6,000		\$4,000		\$11,000		\$2,400,000			
Southern Group	13,200	10,800	\$64,800,000	10,800	\$43,200,000	15,600	\$171,600,000	0	\$0	\$279,600,000	\$21,182
Erie	6,500	5,318	\$31,900,000	5,318	\$21,300,000	7,682	\$84,500,000	0	\$0	\$137,700,000	\$21,185
Lafayette	1,800	1,473	\$8,800,000	1,473	\$5,900,000	2,127	\$23,400,000	0	\$0	\$38,100,000	\$21,167
LHWD	4,900	4,009	\$24,100,000	4,009	\$16,000,000	5,791	\$63,700,000	0	\$0	\$103,800,000	\$21,184
Northern Group	5,900	11,800	\$70,800,000	11,800	\$47,200,000	0	\$0	0	\$0	\$118,000,000	\$20,000
Eaton	1,300	2,600	\$15,600,000	2,600	\$10,400,000	0	\$0	0	\$0	\$26,000,000	\$20,000
Severance	1,300	2,600	\$15,600,000	2,600	\$10,400,000	0	\$0	0	\$0	\$26,000,000	\$20,000
Windsor	3,300	6,600	\$39,600,000	6,600	\$26,400,000	0	\$0	0	\$0	\$66,000,000	\$20,000
Eastern Group	4,900	9,800	\$58,800,000	6,200	\$24,800,000	0	\$0	8.0	\$19,200,000	\$102,800,000	\$20,980
Ft. Morgan	3,600	7,200	\$43,200,000	3,600	\$14,400,000	0	\$0	8.0	\$19,200,000	\$76,800,000	\$21,333
Morgan County QWD	1,300	2,600	\$15,600,000	2,600	\$10,400,000	0	\$0	0	\$0	\$26,000,000	\$20,000
Independent Participants											
Central Weld County WD	8,400	16,800	\$100,800,000	16,800	\$67,200,000	0	\$0	0	\$0	\$168,000,000	\$20,000
Evans	1,600	3,200	\$19,200,000	3,200	\$12,800,000	0	\$0	0	\$0	\$32,000,000	\$20,000
FC-Loveland WD	3,000	0	\$0	0	\$0	6,000	\$66,000,000	0	\$0	\$66,000,000	\$22,000
Ft. Lupton	3,000	6,000	\$36,000,000	3,000	\$12,000,000	0	\$0	6.7	\$16,100,000	\$64,100,000	\$21,367
Total No Action	40,000	58,400	\$350,400,000	51,800	\$207,200,000	21,600	\$237,600,000	14.7	\$35,300,000	\$830,500,000	\$20,763

¹Volume for new wells and treatment assumes 2.5 peak day/average day ratio.

Table 2-6. NISP Estimated Action Alternative Costs.

			Alternative 3	Subalternative 4.1		Subalternative 4.2
	Glade Reservoir plus SPWCP and 40,000 AF Galeton Reservoir		Cactus Hill Reservoir plus SPWCP and 40,000 AF Galeton Reservoir	Glade Reservoir plus SPWCP and 20,000 AF Galeton Reservoir, with Agricultural Transfers		Cactus Hill Reservoir plus SPWCP and 20,000 AF Galeton Reservoir, with Agricultural Transfers
Glade Reservoir	\$157,000,000			\$157,000,000		
Land acquisition for Glade Reservoir	\$10,000,000			\$10,000,000		
Glade Reservoir forebay (MWH 2004)	\$3,000,000			\$3,000,000		
Glade pump station (MWH 2004)	\$33,000,000			\$33,000,000		
U.S. 287 realignment	Northern	Western		Northern	Western	
	\$38,000,000	\$41,000,000		\$38,000,000	\$41,000,000	
Glade to Horsetooth pipeline	\$14,000,000			\$14,000,000		
Poudre Valley Canal upgrade and Glade diversion to Munroe Canal bypass pump station	\$26,000,000			\$26,000,000		
Cactus Hill Reservoir			\$167,192,200			\$167,192,200
Cactus Hill delivery facilities			\$75,000,000			\$75,000,000
Road relocation, land acquisition, powerline, brewery effluent and disposal relocation			\$23,200,000			\$23,200,000
Cactus Hill to Horsetooth pipeline			\$41,800,000			\$41,800,000
Galeton Reservoir	\$48,000,000		\$48,000,000	\$28,000,000		\$28,000,000
SPWCP	\$97,000,000		\$97,000,000	\$51,000,000		\$51,000,000
Agricultural Transfers				\$210,000,000		\$210,000,000
Total Action Alternative	Northern	Western	\$452,192,200	Northern	Western	\$596,192,200
	\$426,000,000	\$429,000,000		\$570,000,000	\$573,000,000	
Carter pipeline	\$52,000,000		\$52,000,000	\$52,000,000		\$52,000,000
Total Action Alternative w/Carter Pipeline Option	Northern	Western	\$504,192,200	Northern	Western	\$648,192,200
	\$478,000,000	\$481,000,000		\$622,000,000	\$625,000,000	
Operations and Maintenance	=0.5% of total capital cost plus pumping cost (\$40/AF)		=0.5% of total capital cost plus pumping cost (\$40/AF)	=0.5% of total capital cost plus pumping cost (\$40/AF)		=0.5% of total capital cost plus pumping cost (\$40/AF)

Source:

GEI. 2006a. Technical Memorandum No. 1: Northern Integrated Supply Project (NISP) Preliminary Assessment of Glade Dam and Reservoir and Associated Facilities. Prepared for the NCWCD.

- GEI. 2006b. Technical Memorandum No. 2: Northern Integrated Supply Project (NISP) Preliminary Assessment of Galeton Dam and Reservoir and Associated Facilities. Prepared for the NCWCD.
- GEI. 2006c. Technical Memorandum No. 3: Northern Integrated Supply Project (NISP) Preliminary Assessment of Cactus Hill Dam and Reservoir and Associated Facilities. Prepared for the NCWCD.
- Integra Engineering. 2005a. South Platte Water Conservation Project Alternatives Analysis. Northern Colorado Water Conservancy District Technical Memorandum No. 1. May 2005. Prepared for the Northern Colorado Water Conservancy District.
- Integra Engineering. 2005b. Glade Reservoir to Horsetooth Reservoir Pipeline Route Analysis. Northern Colorado Water Conservancy District Technical Memorandum No. 2. May 2005. Prepared for the Northern Colorado Water Conservancy District.
- Integra Engineering. 2005c. Munroe Canal By-Pass Alternatives Analysis. Northern Colorado Water Conservancy District Technical Memorandum No. 3. April 2005. Prepared for the Northern Colorado Water Conservancy District.
- MWH. 2004. Northern Integrated Supply Project. Phase II Alternative Evaluation Final Report. Prepared for the Northern Water Conservancy District.
- Muller Engineering. May 4, 2006b. Alignment Alternative J. Engineers Opinion of Probable Construction Costs – Conceptual Level
- Muller Engineering. May 4, 2006c. Alignment Alternative F. Engineers Opinion of Probable Construction Costs – Conceptual Level
- NCWCD 2006. Draft memorandum regarding NISP Alternative Costs. March 21, 2006. From Mr. Carl Brouwer to Mr. Jerry Kenny.

Chapter 3

Affected Environment

3.1 INTRODUCTION

Chapter 3 describes the affected environment for the District's Proposed Action and for the other alternatives considered. The affected environment refers to the location and resources that comprise that location, which have the potential to be directly or indirectly affected by the alternatives. The locations are referred to as study areas in Chapter 3. Chapter 3 presents a summary of existing information to provide context for the assessment of impacts presented in Chapter 4. Most of the alternatives and their various components have resources common to the region. Table 3-1 summarizes the resources and issues that distinguish the reservoir alternatives. Table 3-2 summarizes the resources and issues that distinguish the corridor study areas. These summaries are not comprehensive, but present differences among the reservoir study areas and corridor study areas.

3.1.1 Chapter Organization

Chapter 3 first presents a brief description of the study areas for the alternatives and their components, and then describes each of the existing resources or issues. For most resources, descriptions of the resource are provided for each study area. To minimize repetition, resources common to all or multiple alternatives are described once, and differences in the resources among the study areas are described under each study area. Some issues or resources such as water rights, socioeconomics,

Table 3-1. Summary of Resources and Issues that Distinguish the Reservoir Alternatives.

Resource	Glade Reservoir	Galeton Reservoir	Cactus Hill Reservoir
Native Vegetation	Areas of upland native grasslands and upland native shrublands, some of which are uncommon communities tracked by the CNHP.	Areas of upland native grasslands.	Areas of upland native grasslands.
Wetlands	About 45 acres of wetlands.	Less than 1 acre of wetlands.	About 45 acres of wetlands.
Wildlife	Mule deer winter concentration area, and deer and elk highway crossings.	Pronghorn winter concentration area and severe winter range.	No concentration areas designated.
Species of Concern	Known Preble's habitat; common gartersnakes and leopard frogs observed onsite.	240-acre black-tailed prairie dog colony; swift fox and burrowing owl observed onsite.	Scattered small black-tailed prairie dog colonies with burrowing owls observed.
Cultural Resources	Two recorded sites either field eligible or officially eligible for or listed in the NRHP.	Six recorded sites have been recommended or determined eligible for inclusion in the NRHP.	Three recorded sites have been recommended or determined eligible for inclusion in the NRHP.
Hazardous Sites	TCE plume beneath a portion of the forebay.	No known hazardous sites.	No known hazardous sites.
Land Use	A portion of U.S. 287 would be displaced by the reservoir.	Forebay occurs within the Mitani-Tokuyasu State Wildlife Area.	Land disposal site for brewery wastewater.

visual resources, and land use are not presented by study area because they are better described by alternative, participant, or region.

Descriptions of the affected environment for the U.S. 287 study area are presented separately in Section 3.27. Resources and issues such as noise, air quality, transportation and traffic, and paleontology are potentially more significant for the proposed realignment of U.S. 287 and are only presented in Section 3.27. Additionally, it became clear during the scoping process that much of the public was interested in the proposed realignment of U.S. 287. The separate presentation of this information should facilitate review by those primarily interested in U.S. 287 realignment issues.

More detailed information is provided in the technical reports for each resource. The Corps completed numerous engineering and environmental studies for the alternatives. These studies are

documented in technical reports and memorandums, and are available by submitting a written request to the Corps at the following address:

Mr. Chandler Peter
NEPA EIS/404(b)(1) Coordinator
Denver Regulatory Office
U.S. Army Corps of Engineers, Omaha District
9307 South Wadsworth Boulevard
Littleton, Colorado 80128-6901
Chandler.J.Peter@usace.army.mil

Some information in the technical reports may differ from that presented in this EIS where the alternative information, design, or analyses have been updated subsequent to the technical reports. The technical reports used in preparation of this chapter are listed in the references cited in Chapter 7.

Table 3-2. Summary of Resources and Issues that Distinguish the Corridor Study Areas.

Resource	Glade to Horsetooth Pipeline	Carter Pipeline	SPWCP Pipeline and Diversion	Cactus Hill to Horsetooth Pipeline	U.S. 287 Realignment Alternatives	Poudre-South Platte Corridor
Native Vegetation	Native shrublands; upland native woodlands.	Native shrublands.	-- ¹	--	Native foothills shrublands.	--
Riparian Resources	--	--	--	--	--	Much of the corridor supports riparian habitats.
Wildlife	Crosses mule deer and white-tailed deer winter concentration areas.	Crosses mule deer winter concentration areas.	Mule deer severe winter range at the confluence of the Poudre and South Platte River.	White-tailed deer winter concentration areas at Poudre River crossing.	--	White-tailed deer winter concentration areas.
Species of Concern	Crosses occupied Preble's habitat; crosses near active bald eagle nest.	--	--	--	Large population of Bell's twinpod.	Three active bald eagle nests in corridor. Two spotted skipper, smokey-eyed brown butterfly, and American currant observed.
Paleontological Resources	--	--	--	--	Western alternative involves a road cut through the Morrison Formation, which is known to contain fossils.	--

¹Distinguishing resources or issues not known for the corridor study area.

3.2 STUDY AREAS

3.2.1 No Action Alternative Study Areas

For all of the Participant groups and the independent Participants, the No Action alternative would involve transfer of water from agricultural lands. The exact locations of these lands are unknown, but it is estimated that about 69,200 acres of irrigated agricultural lands would be dried up under the No Action alternative. Agricultural water transferred under this alternative would be stored in gravel pit lakes. There are many possible alternative gravel pit storage sites within the project area (see Figure 3 in the Water Resources Technical Report, HDR 2007b).

3.2.1.1 Group 1—Southern Group

The Southern Group would pursue storage in gravel pits along Boulder Creek downstream of Longmont. These gravel pits would be acquired from existing gravel mines, and although they are located in riparian areas, the vegetation would have been disturbed by mining prior to the Participants' acquisition of the gravel pits (Figure 2-1).

3.2.1.2 Group 2—Northern Group

The Northern Group would pursue storage in gravel pits along the Cache la Poudre River downstream of Fort Collins. These gravel pits would be acquired from existing gravel mines, and although they are located in riparian areas, the vegetation would have

been disturbed by mining prior to the Participants' acquisition of gravel pits.

3.2.1.3 Group 3—*Eastern Group*

The Eastern Group would pursue storage in gravel pits along the South Platte River upstream of Fort Morgan. These gravel pits would be acquired from existing gravel mines, and although they are located in riparian areas, the vegetation would have been disturbed by mining prior to the Participants' acquisition of the gravel pits.

3.2.1.4 *Independent Participants*

Under the No Action alternative, four Participants would pursue new sources of water supplies independently. The study areas for these Participants are described in this section.

CWCWD. The No Action alternative study area for the CWCWD is gravel pit storage along the South Platte River to the east of Frederick, Firestone, and Dacono.

Evans. The No Action alternative study area for Evans is gravel pit storage on the South Platte River in the vicinity of Evans.

Fort Collins-Loveland Water District. The study area for the Fort Collins-Loveland Water District includes new gravel pit storage on the Cache la Poudre River, and enlargement of one of the North Poudre Irrigation Company Reservoirs.

Fort Lupton. Fort Lupton would construct new water storage as part of the No Action alternative. This new water storage likely would be a gravel pit along the South Platte River in the vicinity of Fort Lupton.

3.2.2 Glade Reservoir Study Area

The Glade Reservoir study area and its associated forebay occur within a series of north/south oriented ridges (or hogbacks) and valleys at the base of the Rocky Mountain foothills (Figure 2-2). Glade Reservoir would have a 170,000 AF capacity, and would have a dead pool of between 3,000 to 4,000 AF. The western edge of the proposed reservoir site is located in the rocky, pine forest-covered toe of the foothills. A narrow, shrub-dominated sandstone hogback (the first of the series of hogbacks) lies east of the foothills. This hogback (the first hogback) would separate the eastern and western portions of the proposed Glade Reservoir. An unnamed ephemeral tributary to the Cache la Poudre River meanders north to south through an open valley between the foothills and the first hogback. East of the first hogback is a second, taller hogback, with the existing U.S. 287 corridor running parallel between these two hogbacks. The North Poudre Supply Canal meanders from south to north across the Glade Reservoir study area. The Glade Reservoir study area includes the Munroe Canal bypass (a tunnel under Glade Reservoir) and the Munroe Canal relocation option.

3.2.3 U.S. 287 Realignment Study Area

Two realignment alternatives for U.S. 287 are proposed (Figure 2-4). Both potential realignments would follow a common route in the south beginning at the existing U.S. 287 and proceed north through the reclaimed Holcim Mine, which occurs on a shale/limestone ridge and consists mostly of spoil piles. At the north end of the Holcim Mine, the two proposed realignments would diverge into a western and northern alignment. The western realignment alternative would cross two valleys supporting a mix of native and introduced grasslands

with several large wet meadows divided by a north/south trending hogback covered with shrublands and grasslands. The northern realignment alternative would extend north of the Holcim Mine across a landscape similar to the western realignment to Owl Canyon Road where the proposed pipeline would approximately follow Owl Canyon Road to U.S. 287. Two large canals, the North Poudre Supply Canal and the Poudre Valley Canal, meander from southwest to northeast across the U.S. 287 realignment study area.

3.2.4 Galetton Reservoir and SPWCP Study Area

The Galetton Reservoir study area is located in a broad basin about 10 miles east of the Town of Ault in Weld County, Colorado (Figure 2-2). Galetton Reservoir would have a 20,000 or 40,000 AF capacity, depending on the alternative, and would not have a dead pool. The Galetton study area consists primarily of dry rangeland that has been grazed in recent years. Two broad ephemeral drainages, vegetated with predominantly upland species, occur within the Galetton Reservoir study area. Small basins or depressions within these drainages and within isolated areas outside the drainages occasionally collect water. A small stock pond surrounded by a narrow margin of wetlands occurs within the easternmost drainage. The Galetton Reservoir study area is surrounded by rangeland and agricultural land.

The proposed SPWCP consists of a series of pipeline routes connecting Galetton Reservoir, the Larimer-Weld Canal, the New Cache Canal, and the proposed diversion from the South Platte River as shown in Figure 2-2. The SPWCP study area is located within agricultural land and rangeland with several canals and streams crossing the study area.

Riparian woodlands occur along the South Platte River and along some of the drainages.

3.2.5 Cactus Hill Reservoir Study Area

The Cactus Hill Reservoir study area is located northeast of Fort Collins in Weld County (Figure 2-3). Cactus Hill Reservoir would have an 180,000 AF capacity, and would have a dead pool of between 3,000 to 4,000 AF. This study area includes the proposed construction of a pump station and a pipeline segment that would convey water from Cobb Lake to Cactus Hill Reservoir. The study area includes proposed Weld County road realignments, and a power line realignment that would be moved as shown in Figure 2-3. Most of this study area consists of agricultural fields and rangeland with patches of mesic grasslands and riparian woodlands along the ditches and drainages. Black Hollow Reservoir, which is surrounded by riparian woodlands, occurs in the southeastern portion of the study area.

3.2.6 Glade to Horsetooth Pipeline Study Area

The proposed Glade to Horsetooth pipeline route (Figure 2-2) would start at Glade Reservoir and go south to the north end of Horsetooth Reservoir. At the northern end of the Glade to Horsetooth pipeline study area, the pipeline route would cross agricultural lands and rangelands, as well as the Cache la Poudre River, with its associated riparian woodland. At the southern end of the study area, the pipeline route would cross a series of hogbacks and small drainages before connecting to Horsetooth Reservoir.

3.2.7 Carter Pipeline Study Area

The Carter pipeline study area would extend from the proposed Glade Reservoir or Cactus Hill Reservoir to the SWSP east of Carter Lake (Figure 2-4). Starting at the Glade Reservoir site, the proposed pipeline route would proceed south to just north of Horsetooth Reservoir, crossing landscape similar to the landscape in the Glade to Horsetooth pipeline study area. The proposed Carter pipeline route then would proceed south of Horsetooth Reservoir to connect with the SWSP south of Carter Lake. The landscape consists of a series of hogbacks and valleys near Horsetooth Reservoir and Carter Lake. Between the two reservoirs, the land is mostly agricultural except for urban areas within the City of Loveland. Several drainages, including the Big Thompson River, occur along the proposed pipeline route. For alternatives that include the Cactus Hill Reservoir, the Carter pipeline would begin south of the Cactus Hill pipeline and proceed to the connection with the SWSP (Figure 2-4).

3.2.8 Poudre Valley Canal Study Area

The study area for the existing Poudre Valley Canal extends west from south of the proposed Glade Reservoir through the Holcim Mine to east of Cobb Lake (Figure 2-2). The Poudre Valley Canal would convey water from the Cache la Poudre River to the proposed Cactus Hill Reservoir. West of the Holcim Mine, the Poudre Valley Canal travels through agricultural lands, rangelands, and scattered residential lots. East of the Holcim Mine, the Poudre Valley Canal travels near three reservoirs and crosses several drainages with associated wetlands and riparian woodlands.

3.2.9 Cactus Hill to Horsetooth Reservoir Pipeline Study Area

The proposed pipeline from Cactus Hill to Horsetooth Reservoir would convey water from the proposed Cactus Hill Reservoir to the proposed Carter pipeline east of Horsetooth Reservoir (Figure 2-3). This study area contains agricultural lands, grasslands, and the northern portion of Fort Collins. The Cache la Poudre River and other drainages, canals, and reservoirs also occur within the Cactus Hill to Horsetooth Reservoir study area.

3.2.10 Agricultural Transfer Lands Study Area

The Agricultural Transfer Lands study area includes irrigated agricultural lands supplied by water from the Larimer-Weld canal and the New Cache Canal east of Fort Collins. Alfalfa, corn, grass/pastureland, and other types of crops are grown on these irrigated agricultural lands (Figure 2-4).

3.2.11 Cache la Poudre and South Platte River Study Areas

The NISP alternatives could affect some resources, such as fisheries and riparian vegetation associated with changes in flows in the Cache la Poudre and South Platte rivers. The study area for these rivers is the Cache la Poudre River from the Munroe Canal diversion downstream to the confluence with the South Platte River. The South Platte River study area includes the area downstream of the Cache la Poudre River confluence to the Kersey gage (Figure 2-4).

3.3 SURFACE WATER

All of the NISP action alternatives rely on water from the Cache la Poudre and South Platte River

basins. The following is a summary of the surface water in the basins considered for potential water supplies for NISP. This information is summarized from the Water Resources Technical Report (HDR 2007b).

3.3.1 Cache la Poudre River Basin

Located in north-central Colorado and part of south-central Wyoming, the Cache la Poudre River Basin (Poudre Basin) is a major tributary to the South Platte River. Flowing generally west to east, the headwaters of the Poudre are located high in the Rocky Mountains at the Continental Divide. The confluence of the Poudre and South Platte rivers is on the plains east of the City of Greeley. In Colorado, about 80 percent of the Poudre Basin is located in Larimer County, and the remaining 20 percent is in Weld County. The Poudre Basin is composed of two distinct topographic regions: the mountainous, forested, sparsely inhabited upper Poudre Basin that generates most of the Poudre Basin water supply (1,890 square miles), and the plains of the lower Poudre Basin (840 square miles), which are home to the agriculture, industry, and municipalities that consume the water supply.

Elevations in the Poudre Basin range from about 4,600 feet at the confluence to 5,300 feet at the canyon mouth to over 13,000 feet near the headwaters. Much of the land in the upper Poudre Basin is included in Rocky Mountain National Park or the Roosevelt National Forest. Nearly all of the upper reaches of the Poudre River, including the South Fork, from the headwaters at Poudre Lake downstream to Poudre Park (a few miles above the canyon mouth) are designated as Wild and Scenic River segments.

The Colorado Water Conservation Board has four decreed instream flow water rights establishing minimum flow requirements on the Poudre River

mainstem (CWCB 2003). These extend from the confluence of the Cache la Poudre River and La Poudre Pass Creek along the northwest boundary of Rocky Mountain National Park downstream to the Wild & Scenic River terminus at Poudre Park. Appropriation dates for the instream flow water rights are in the mid-1980s. Approximately 52 additional CWCB instream flows are decreed throughout the upper Poudre Basin, including on the North and South Forks and other tributary streams.

Because of existing conditional water rights held by the District, the Poudre Basin is the primary source for developing water supply for NISP. Other potential sources include the lower South Platte River, the Big Thompson River, and St. Vrain Creek as discussed in Chapter 2.

3.3.1.1 Water Supply

Surface water is supplied to the Poudre Basin by precipitation and runoff and transbasin diversions. This section summarizes the water sources in the Poudre Basin.

3.3.1.1.1 Precipitation and Runoff

Annual precipitation in the Poudre Basin is closely correlated to elevation, varying from 12 inches per year near Greeley to nearly 40 inches per year in the headwaters region (CWRPDA 1987). Based on data developed by the District for 1950 through 2003, this precipitation results in synthesized natural flows averaging approximately 278,600 AF at the mouth of Poudre Canyon, which is equivalent to about 385 cfs on an average annual basis; in actuality, the flow rate in the river exhibits a great deal of temporal variation. Most of the precipitation, particularly in the upper Poudre Basin, occurs as snow, which melts and runs off primarily during May through July each year (Figure 3-1). Total annual volumes vary considerably from year-to-year (Figure 3-2).

Figure 3-1. Average Daily Flow at the Mouth of Poudre Canyon, Historical Gage Data, 1950–2004.

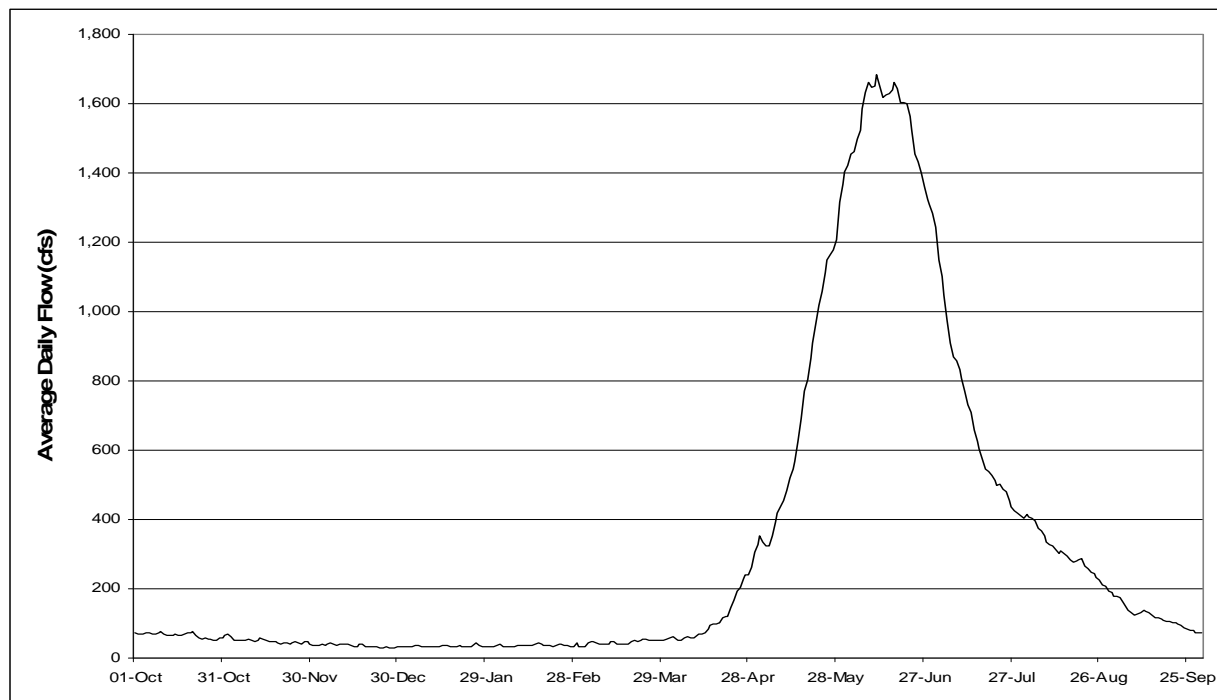
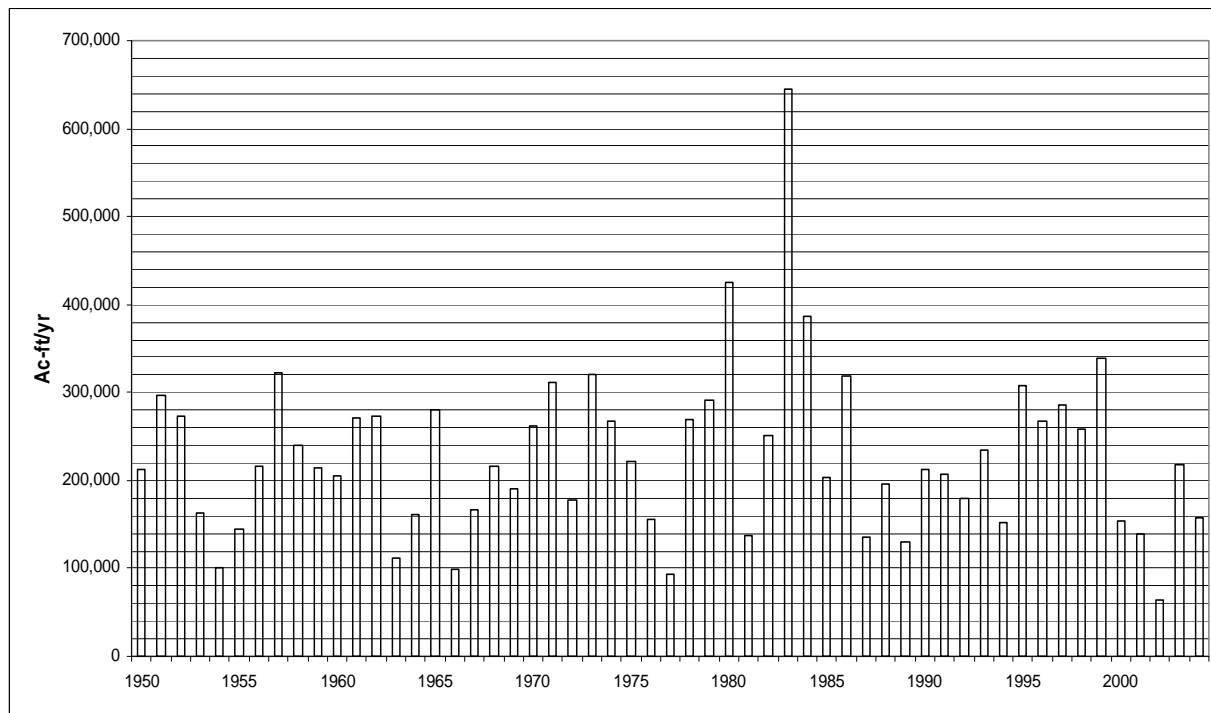


Figure 3-2. Annual Flow Volume at the Mouth of Poudre Canyon, 1950–2005.



In general, annual runoff peaks appear to follow cyclic patterns, with repeated stretches of increasing and decreasing flows. Local precipitation and runoff benefit the lower Poudre Basin, but the upper Poudre Basin runoff constitutes the single largest component of the overall Poudre Basin water supply.

The USGS and DWR operate a number of streamflow gages on the Poudre and other rivers. Four gage locations are of particular interest for hydrologic analyses for the NISP EIS (Table 3-3). Gaged streamflows represent actual river conditions and reflect diversions and other human activities.

3.3.1.1.2 Transbasin Imports

Additional water supply is delivered to the Poudre Basin by a series of transbasin imports (Table 3-4 and Table 3-5). These imports originate in the Colorado, Laramie, or North Platte River basin and are delivered to the headwaters of the Poudre River by ditches or tunnels. Three interstate compacts potentially affect operations of some of the transbasin diversions: 1) the North Platte River

Basin Decree; 2) the Laramie River Decree; and 3) the Sand Creek Memorandum of Agreement.

If Columbine Ditch is excluded and Deadman Ditch is not double-counted, the total annual average of transbasin imports to the upper Poudre Basin is 38,764 AF. Ownership in the various importing ditches is held by: Divide Reservoir and Canal Company; Water Supply and Storage Company; Larimer Weld Irrigation Company; City of Fort Collins; and City of Greeley.

The C-BT Project is also a key source of supply for many Poudre Basin water users. This transbasin project collects flow from the headwaters of the Colorado River and delivers it through a series of canals, tunnels, and pipelines to the Big Thompson River Basin (Section 1.3.1). Historically, agricultural irrigation was the major user of C-BT water, but today M&I entities use a greater percentage of the C-BT supply. Total C-BT deliveries to the Poudre Basin for 2003 were estimated to be approximately 93,200 AF, split 57,200 AF to agriculture and 36,000 AF to M&I (Gibbens 2006).

Table 3-3. Streamflow at Key Gages on the Poudre and South Platte Rivers, 1950–2004.

Gage Location	USGS Gage ID Number	Colorado DWR ID Code	Period of Record	Average Annual Streamflow ¹ (AF)
Poudre River at mouth of canyon near Fort Collins	06752000	CLAFTCCO	WY 1885–2006	262,901
Poudre River at Lincoln St. in Fort Collins	06752260	CLAFORCO	WY 1976–2006	112,344
Poudre River near Greeley	06752500	CLAGRECO	WY 1915–1919, 1925–2006	98,407
South Platte River at Kersey	06754000	PLAKERCO	WY 1902–1903, 1906–1912, 1915–2006	632,353

¹Average annual streamflow values based on USGS historical gaged streamflow values, supplemented as necessary by Colorado Division of Water Resources (DWR) records from the CDSS HydroBase.

Table 3-4. Transbasin Diversion Structures Delivering to the Poudre Basin.

Importing Ditch or Tunnel	Basin of Origin	Decreed Flow Rate
Grand River Ditch	Colorado River	524.6 cfs; 347.0 cfs maximum observed daily diversion
Laramie-Poudre Tunnel	Laramie River	300 cfs; limited by Laramie River Compact; tunnel design capacity = 1,000 cfs
Skyline Ditch	Laramie River	300 cfs total, headgate + intercepted tributaries; limited by Laramie River Compact
Bob Creek Ditch	Laramie River	60.0 cfs (less than design capacity)
Columbine Ditch	Laramie River	N/A; ditch operations ceased after WY 1956
Deadman Ditch	Laramie River	N/A; no associated direct flow water rights
Wilson Supply Ditch	Sand Creek	N/A; no associated direct flow water rights; 156.0 cfs maximum observed daily diversion; limited by Laramie River Compact and Sand Creek MOA
Cameron Pass Ditch	North Platte River	28.0 cfs; subject to North Platte River Basin decree; 12 cfs maximum observed daily diversion
Michigan Ditch	North Platte River	340.0 cfs; limited to 146 cfs; 88.0 cfs maximum observed daily diversion

Table 3-5. Average Monthly and Annual Transbasin Imports to Poudre Basin, 1950–2004.

Month	Grand River Ditch	Laramie-Poudre Tunnel	Skyline Ditch	Bob Creek Ditch ⁴	Columbine Ditch ¹	Deadman Ditch ²	Wilson Supply Ditch ^{2,3}	Cameron Pass Ditch	Michigan Ditch
Oct	4	18	0	0	0	0	0	0	33
Nov	0	0	0	0	0	0	0	0	23
Dec	0	0	0	0	0	0	0	0	16
Jan	0	0	0	0	0	0	0	0	11
Feb	0	0	0	0	0	0	0	0	8
Mar	0	0	0	0	0	0	0	0	7
Apr	11	24	0	0	0	1	4	0	16
May	1,251	2,409	74	91	26	191	1,038	2	185
Jun	7,852	4,730	692	103	69	349	803	68	879
Jul	6,143	5,817	522	3	7	70	90	29	569
Aug	1,938	2,316	22	0	0	2	4	0	183
Sep	348	353	4	0	0	0	0	0	78
TOTAL	17,548	15,666	1,314	198	102	612	1,939	100	1,999

¹For Columbine Ditch, the CDSS HydroBase records include only water years 1950–1956. According to SPDSS (2004), Columbine Ditch no longer diverts, but the water rights remain active.

²Deadman Ditch diverts water from the Laramie River into Sand Creek. Wilson Supply Ditch re-diverts the water and delivers it to Sheep Creek, a tributary to the North Fork of the Poudre River. Water from Sand Creek can also be diverted through the Wilson Supply Ditch. Diversions for both ditches are recorded by the state (SPDSS 2004).

³Includes Deadman Ditch.

⁴Bob Creek Ditch average deliveries are based on records for water years 1950–1956 and 1998–2004. The ditch was not in operation for the period of water years 1957–1997 (SPDSS 2005).

3.3.1.2 Water Use

This section summarizes surface water uses in the Poudre Basin. The Poudre Basin has a long history of agricultural water use, and also has increasing municipal and industrial uses. Figure 3-3 shows the trend of increasing municipal pipeline diversions. Figure 3-4 and Figure 3-5 show the locations of major diversions and returns on the Poudre River.

3.3.1.2.1 Agricultural Use

Agriculture has long been the dominant user of water in the Poudre Basin. Historical average diversions for the 22 irrigation ditches that divert the majority of the irrigation water from the Poudre River are provided in Table 3-6. Dry-year diversions are reported as the smallest annual diversion volume during the 55-year period from 1950 to 2004.

The combined average annual diversions for these 22 ditches total 407,450 AF. Other small ditches occur within the Poudre Basin, but those identified in Table 3-6 account for most irrigation diversions. The recorded diversions for each irrigation ditch include all sources, such as native river water, transbasin imports, C-BT, and exchanges. Many ditches, particularly those in the lower Poudre Basin, rely on return flows from upstream uses to meet irrigators' demands.

The North Poudre Canal, Larimer County Canal, Larimer & Weld Irrigation Canal, and the New Cache la Poudre Co. Ditch (aka Greeley No. 2) are regarded as the "Big Four" ditches in the Poudre Basin. Collectively, these four ditches account for 226,092 AF, or nearly 56 percent of Poudre irrigation diversions each year on average. The North Poudre Supply Canal (aka Munroe Gravity Canal) is part of the North Poudre Irrigation Co. system; likewise, the Cache la Poudre Ditch (aka the

Little Cache Ditch) and Poudre Valley Canal are part of the Larimer Weld Irrigation Company system. If diversions for these ditches are added to the Big Four totals, the systems operated by the Big Four account for nearly 71 percent of agriculture diversions from the Poudre River.

3.3.1.2.2 Municipal and Industrial Use

Presently, the cities of Fort Collins and Greeley, along with the Tri-Districts (FCLWD, East Larimer County Water District, and NWCWD), are the dominant users of M&I water in the Poudre Basin. The average annual diversions by Greeley and Fort Collins through the cities' respective pipelines have climbed steadily from the 1950s to the present (Figure 3-3).

As with the agricultural diversions, Fort Collins, Greeley, and the Tri-Districts do not account for all M&I use in the Poudre Basin. Although these three entities are the most significant, there are many other smaller municipalities and rural domestic water providers in the Poudre Basin. In addition, industrial enterprises such as Kodak near Windsor and the Anheuser-Busch bottling plant northeast of Fort Collins use significant quantities of Poudre River water each year.

3.3.2 South Platte River

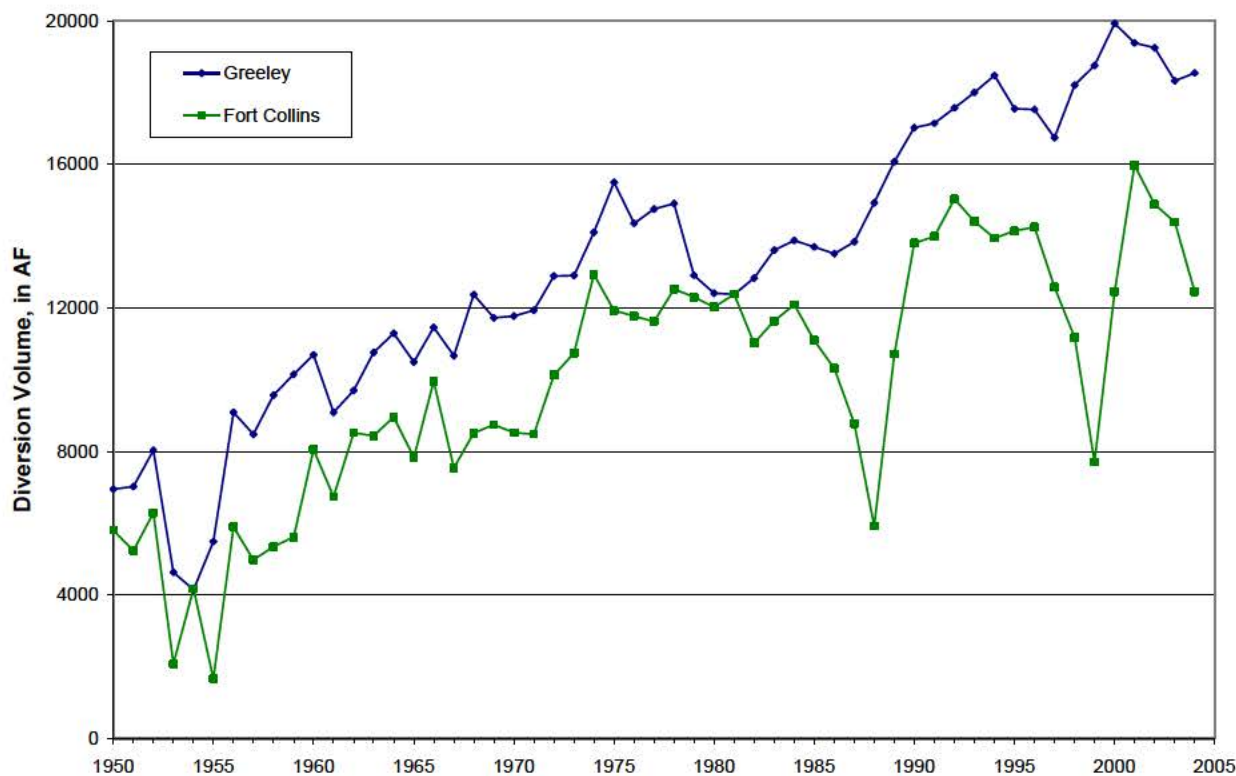
In the NISP study area, the lower South Platte River extends from the South Platte-Poudre confluence downstream to the Colorado-Nebraska state line near Julesburg. This reach of river is included in Water Districts 1 (Greeley to Balzac) and 64 (Balzac to State Line). The South Platte River Compact stipulates that Colorado must deliver a minimum of 120 cfs to Nebraska between April 1 and October 15. For the rest of the year, Colorado has the right to full use of its South Platte waters.

Table 3-6. Major Poudre Basin Irrigation Diversions, 1950–2004.

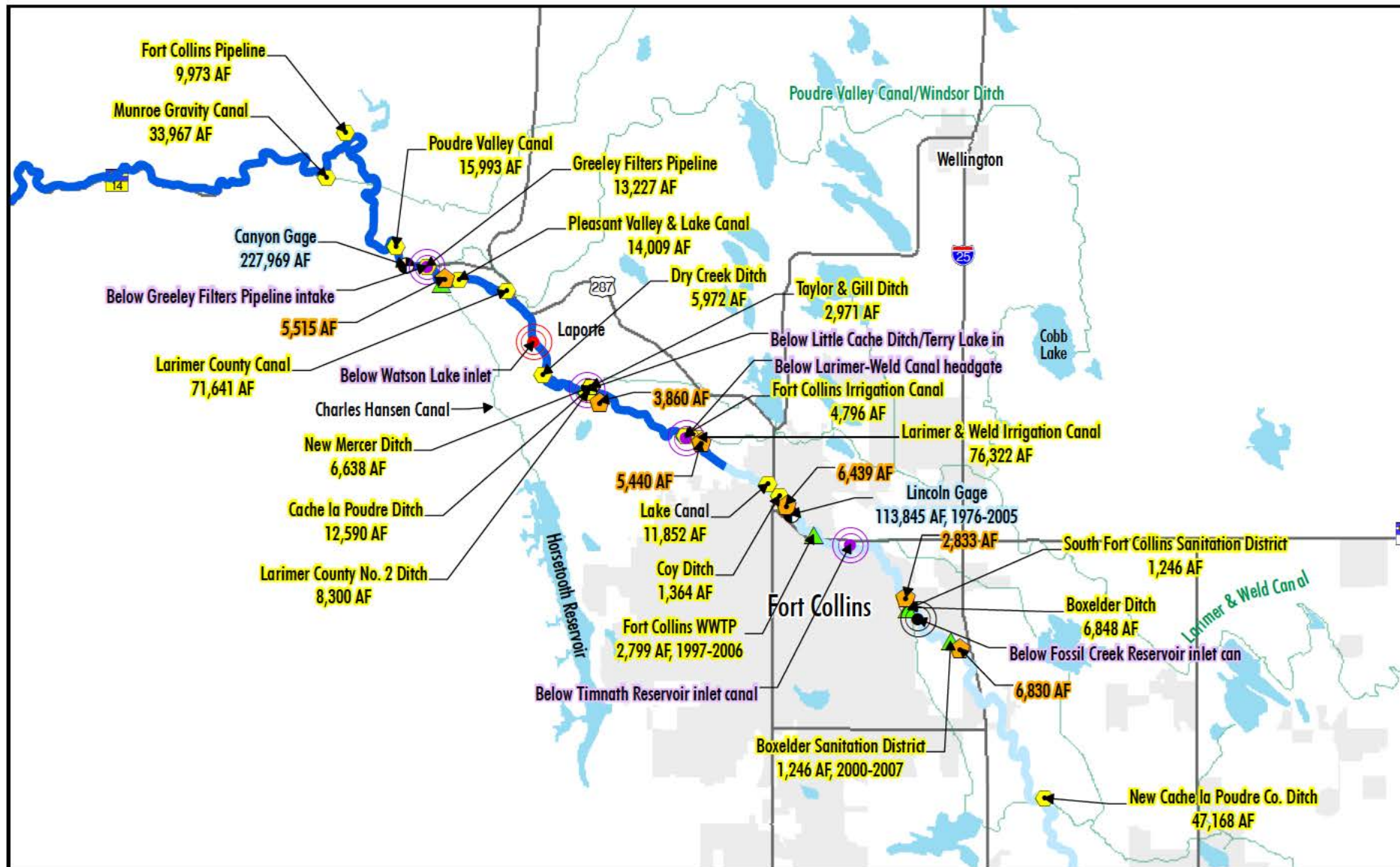
Ditch	SEO Structure ID Number	Average Annual Diversion (AF)	Dry-Year Diversion (AF)
BH Eaton Ditch	931	5,246	2,428
Boxelder Ditch	926	6,848	3,394
Cache la Poudre Ditch (aka Little Cache)	915	12,590	4,518
Canal No. 3 (aka Greeley No. 3)	934	19,003	10,880
Dry Creek Ditch (aka Jackson Ditch)	912	5,972	3,144
Fort Collins Irrigation Canal (aka Arthur Ditch)	918	4,796	1,400
Lake Canal	922	11,852	3,365
Larimer County No. 2 Ditch	914	8,300	1,068
Larimer County Canal	911	71,641	32,444
Larimer and Weld Irrigation Canal	919	76,322	21,815
New Cache la Poudre Co. Ditch (aka Greeley No. 2)	929	47,168	19,510
New Mercer Ditch	913	6,638	3,021
North Poudre Canal	994	30,961	2,819
Ogilvy Ditch	937	15,842	8,912
Pleasant Valley and Lake Canal	910	14,009	7,811
Taylor and Gill Ditch	1029	2,971	1,720
Whitney Irrigation Ditch	930	11,475	7,849
William R. Jones Ditch	932	3,482	737
Munroe Canal (aka North Poudre Supply Canal) ¹	905	33,967	19,957
Poudre Valley Canal	907	15,993	397
Coy Ditch	923	1,364	301
Boyd Freeman Ditch	935	1,010	37
Totals		407,450	157,527

¹The period of record for the Munroe Canal is WY 1954–2004; the ditch was built as part of the C-BT Project.
Source: CDSS 2005.

Figure 3-3. Municipal Diversions¹ by Greeley and Fort Collins, 1950–2004.



¹Municipal diversion volumes based on CDSS HydroBase diversion records for Greeley Filters pipeline (Structure ID 0300908) and Fort Collins pipeline (Structure ID 0300906). Volumes are total river diversions through structures.



Prepared by:
ERO

- ~ Aquatic Life Cold Classification (CO WQCC)
- ~ Aquatic Life Warm Classification (CO WQCC)
- ▲ Discharge
- Diversion
- USGS Stream Gage
- Nonpoint Return Flows
- Poudre River Dry Up Points
- Irrigation Season
- Winter
- Irrigation Season and Winter

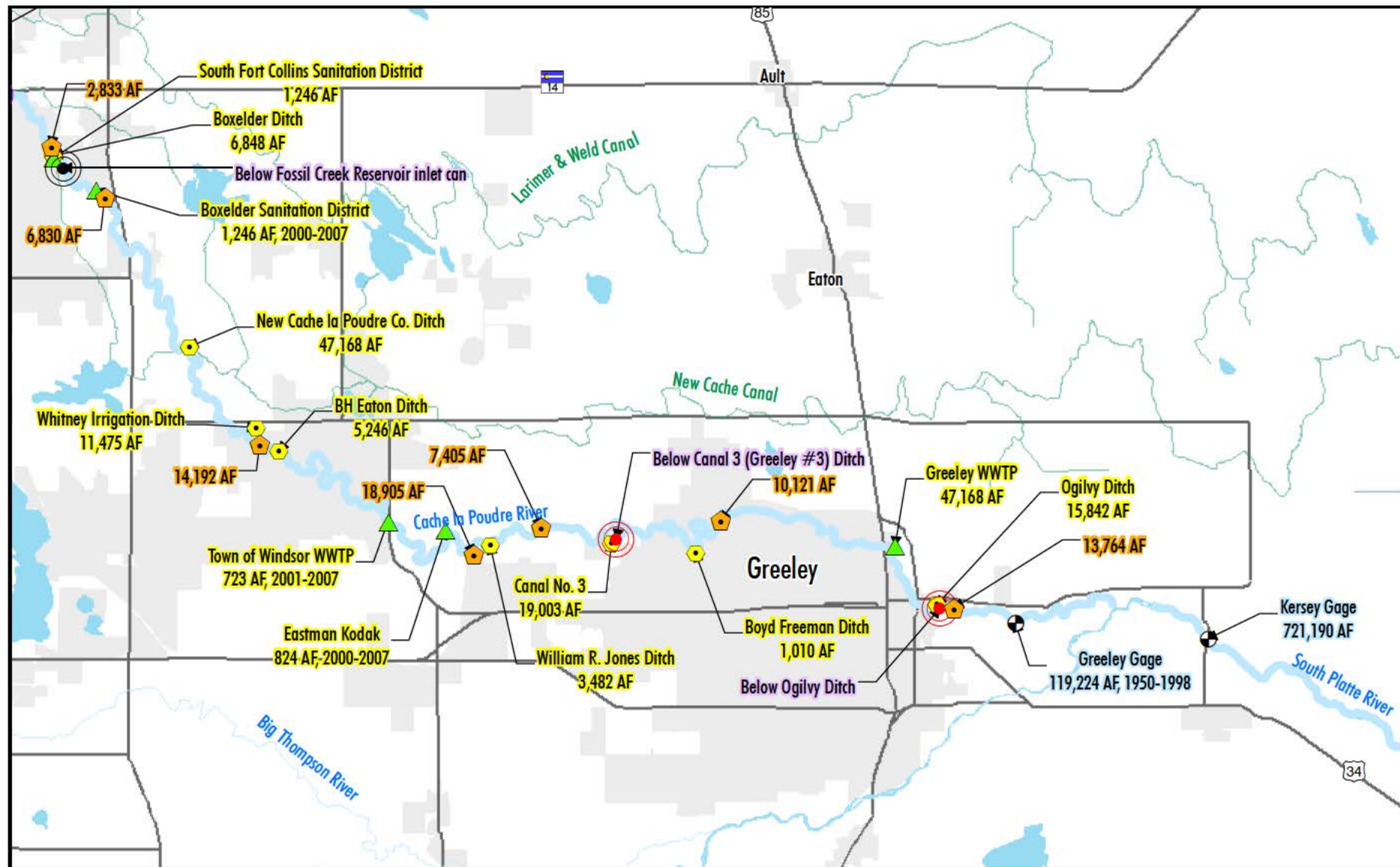
Note: Diversion and gage flow volumes are averages for 1950-2004 unless otherwise noted, non-point return flows are estimated for 1950-1999.

0 8,000 16,000 Feet



Figure 3-4
Cache la Poudre and South Platte River Average Annual Gage Flows, Major Diversions and Discharges, to Fort Collins

Prepared for: U.S. Army Corps of Engineers
File: 2701 Diversions_Discharge_North.mxd (JP)
October 16, 2007



Environmental Impact Statement

Prepared by:
ERO

- Aquatic Life Cold Classification (CO WQCC)
- Aquatic Life Warm Classification (CO WQCC)
- Discharge
- Diversion
- USGS Stream Gage
- Nonpoint Return Flows

- Poudre River Dry Up Points**
- Irrigation Season
- Winter
- Irrigation Season and Winter

Note: Diversion and gage flow volumes are averages for 1950-2004 unless otherwise noted, non-point return flows are estimated for 1950-1999.

0 8,000 16,000 Feet



Figure 3-5
Cache la Poudre and South Platte River Average Annual Gage Flows, Major Diversions and Discharges, Downstream of Fort Collins

Prepared for: U.S. Army Corps of Engineers
File: 2701 Diversions_Discharge_South.mxd (JP)
October 16, 2007

The reach between the confluence and the USGS gage at Kersey is the most important South Platte River reach for NISP due to the potential for SPWCP diversions. Peak runoff occurs primarily in May through early July (Figure 3-6). Total annual flow volumes vary considerably from year to year (Figure 3-7). Because of limited precipitation and runoff in the lower South Platte River Basin, surface water users are highly dependent on return flows from upstream use of native river water and C-BT water.

Nineteen major ditches divert a combined average of 432,166 AF of surface water in District 1 each year (Scott and Paulson 2003). In District 64, 23 ditches divert a combined average of 179,502 AF. For individual ditches, average annual diversions range from 768 AF per year (Carlson Ditch) to 65,180 AF per year (North Sterling Canal). These ditches serve large acreages of irrigated cropland. They also deliver storage water to several large reservoirs on the lower South Platte River including Riverside, Prewitt, Jackson, Empire, North Sterling, and Jumbo (Julesburg) reservoirs.

Figure 3-6. Average Daily Flow, South Platte River near Kersey (USGS gage 06754000), WY 1902–1903, 1906–1912, and 1915–2006.

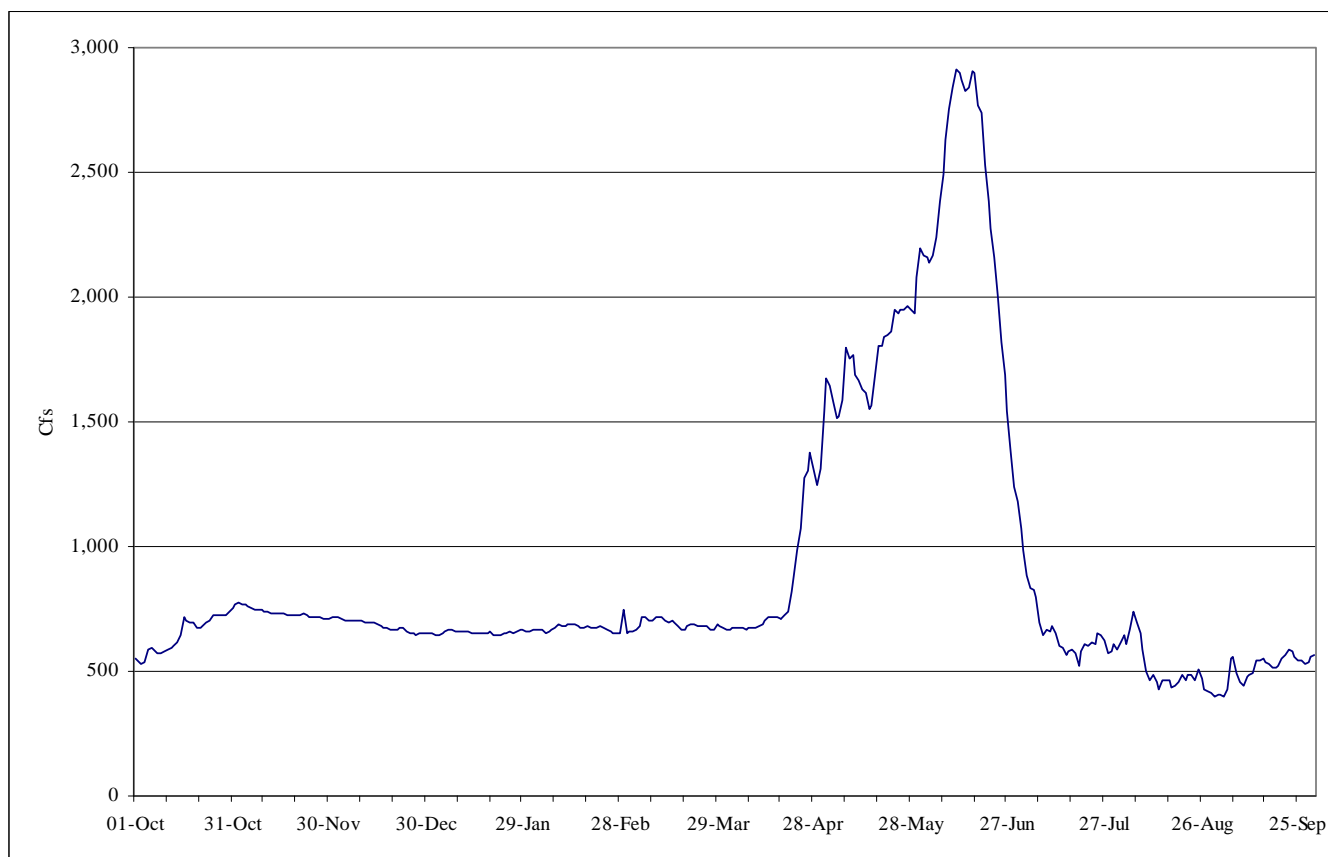
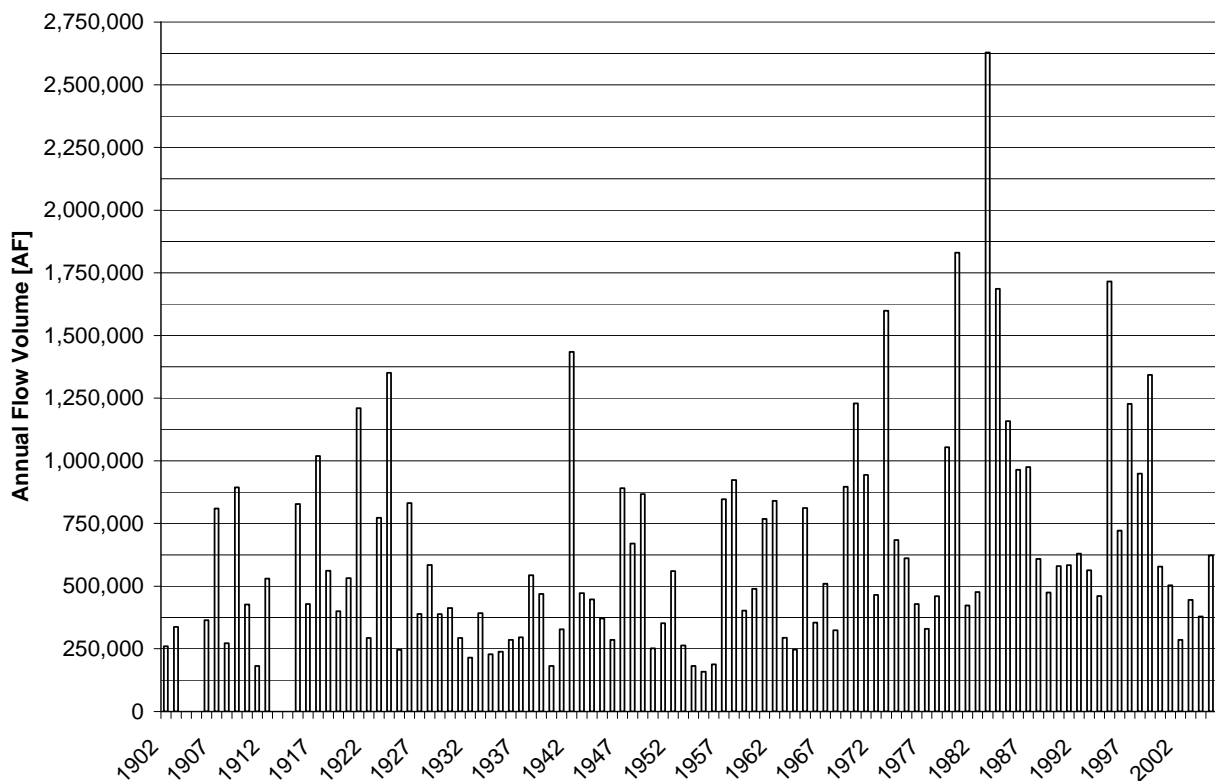


Figure 3-7. Annual Flow Volumes¹, South Platte River near Kersey (USGS gage 06754000), 1902–2006.



¹Colorado Division of Water Resources diversion records from the CDSS HydroBase are incomplete for WY 1901, 1904, 1905, 1913, and 1914. Therefore, annual volumes are not shown.

3.3.3 Big Thompson River Basin

The Big Thompson River (Water District 4) headwaters originate in Rocky Mountain National Park on the East Slope of the Continental Divide. It flows eastward to its confluence with the South Platte River near LaSalle, Colorado. The only major tributary is the Little Thompson River. Like most of northeast Colorado, agriculture has historically been the dominant user of water in the Big Thompson Basin. The long-term trend has been an increase in M&I use with a corresponding decrease in agricultural use. The City of Loveland and the City of Greeley are the primary users of M&I water in the Big Thompson Basin.

In addition to native precipitation and runoff, the C-BT Project delivers Colorado River water through the Alva B. Adams Tunnel to the headwaters of the Big Thompson River. This water passes through a series of conduits to terminal storage facilities at Carter Lake and Horsetooth Reservoir. Water is released from these reservoirs to meet the demands of C-BT unit holders. C-BT deliveries to the Big Thompson Basin are estimated at 32,650 AF to agriculture and 8,800 AF to M&I uses (Gibbens 2006).

3.3.4 St. Vrain Creek Basin

St. Vrain Creek Basin (Water District 5) is south of the Big Thompson Basin. The headwaters of North and South St. Vrain creeks form on the East Slope of the Continental Divide in Rocky Mountain National Park or Roosevelt National Forest lands. St. Vrain Creek flows eastward to its confluence with the South Platte River near Platteville, Colorado. Major tributaries include Left Hand Creek and Boulder Creek (Water District 6).

Of the primary basins for C-BT deliveries (Poudre, Big Thompson, and St. Vrain), the St. Vrain is the

only basin in which M&I use currently eclipses agricultural use. This is attributable to the basin's location on the northwest fringe of the Denver Metro area, with more industry and a greater concentration of municipalities (e.g., Boulder, Longmont, Erie, Lafayette, and Louisville).

The viability of developing NISP water supplies in the Big Thompson and St. Vrain basins was assessed as part of the Phase II report (Fardal 2003, 2004) and again as part of the NISP hydrologic model review (HDR 2005a). In all cases, available flows were found to be insufficient for meeting the demands of the NISP Participants (discussed in Chapter 2).

3.4 STREAM MORPHOLOGY

This section discusses stream morphology, which is the form and structure of a stream, including its channel, banks, floodplain, and drainage area. More detailed information on stream morphology can be found in the South Platte River near Kersey Stream Morphology Technical Report and the River Morphology and Sediment Transport Technical Report for the Cache la Poudre River (ERO 2008h; Anderson 2008).

East Slope streamflows, stream morphology, and sediment loads have been thoroughly altered by land-use practices that began with the 1859 gold rush (Wohl 1998). Any land use activity that alters water or sediment input is likely to cause a corresponding change in stream morphology. The net effect of human activities over the past 150 years has been to reduce channel and habitat diversity and stability. The simplifications of river form and function may not be noticeable; however, the altered rivers are less able to support riparian and aquatic life (Wohl 2001).

3.4.1 South Platte River

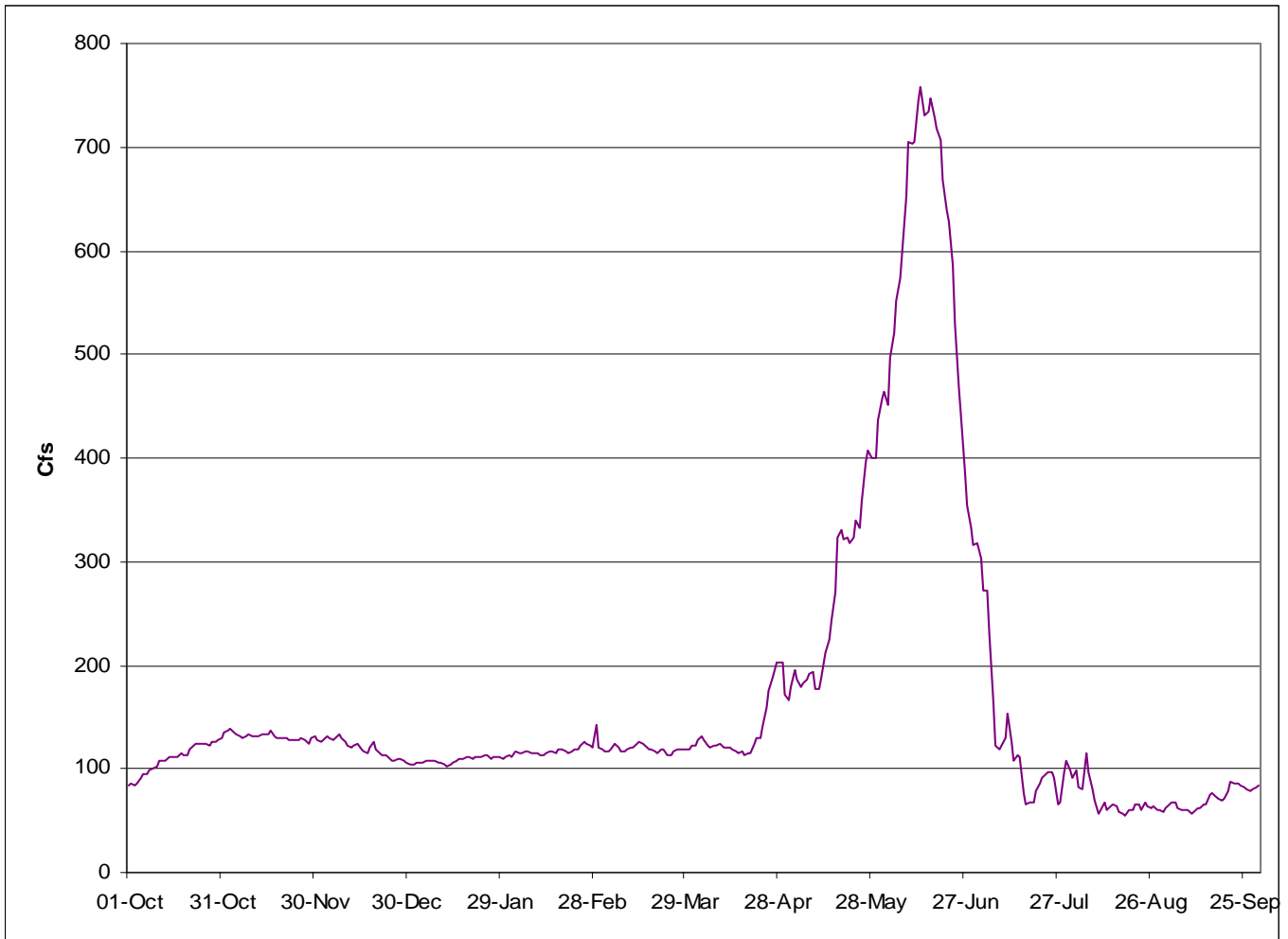
When the first systematic channel surveys of the lower reaches of the South Platte River were conducted in the 1860s, the river had a channel approximately 1 mile wide and 1 to 4 feet deep (Wohl 2001). There were hundreds of small, wooded islands, but vegetation was sparse along the banks. With the development of irrigated agriculture, the river flow changed from large spring flows, with low flows the remainder of the year, to moderate flows spread throughout the year. Agricultural diversions from the South Platte River began in the 1860s; many diversions have adjudication dates that are in the 1800s. Flow data collected by the USGS near Kersey since 1901 show that on average, spring runoff flows occur from late April through early July, with moderate flows of 500 to 700 cfs occurring the remaining 7.5 months of the year (Figure 3-6). Total annual flow volumes for the South Platte River near Kersey are provided in Figure 3-7. In the description of the gaging station, the USGS states that the natural flow of the stream is affected by “transmountain and transbasin diversions, storage reservoirs, power developments, ground-water withdrawals and diversions for irrigation of about 888,000 acres, and return flow from irrigated areas” (USGS 2005a). In addition to direct impacts to river flow at points of diversion and return flows, irrigated agriculture also caused the regional water table to rise; these changes allow streamside vegetation to grow more densely along the banks because the vegetation is less likely to be destroyed by large floods and there is a more dependable water supply throughout the year. Increased stream vegetation has resulted in more trapping of sediment and increased bank stability. The South Platte became more narrow and sinuous with time. In the Kersey area, the river is now about one quarter as wide as it was in the late 1800s. At the present time, the channel of the South Platte

River downstream of the Cache la Poudre River near Kersey is about 250 feet wide, with numerous sandbars along the shoreline and within the channel, forming islands and smaller side channels. The channel gradient is about 0.0002 feet/foot and the width of the floodplain is about 2 miles. The surface geology is Recent unconsolidated alluvium. The channel substrate is sand and gravel. The banks appear stable due to the presence of a dense cover of grasses, willows, and trees.

3.4.2 Cache la Poudre River

It is unknown whether surveys of the plains portion of the Cache la Poudre River were completed before human activities began to affect the streamflow and river channel. However, it is likely that the lower Cache la Poudre River was similar to the lower South Platte, with a considerably wider channel, larger flood flows and lower base flows. The first agricultural diversion from the Cache la Poudre River began in 1867; many diversions have adjudication dates that are in the 1800s. Flow data for the Cache la Poudre River near Greeley were collected by the USGS from 1903 to 1998. In the description of the gaging station, the USGS states that the natural flow of the stream is affected by “transmountain and transbasin diversions, storage reservoirs, power developments, diversion for municipal supply, diversions upstream from [the] station for irrigation of about 250,000 acres, and return flow from irrigated areas” (USGS 2005a). On average, spring runoff flows occur from late April through early July, with moderate flows of 50 to 100 cfs during the rest of July through mid-October and 100 cfs from mid-October until late April (Figure 3-8). Total annual volumes for the Cache la Poudre River near Greeley are provided in Figure 3-9. The average annual diversion of water for agricultural use is considerably greater than the total annual flow

Figure 3-8. Average Daily Flows, Cache la Poudre River near Greeley (USGS gage 06752500), 1950–1998.

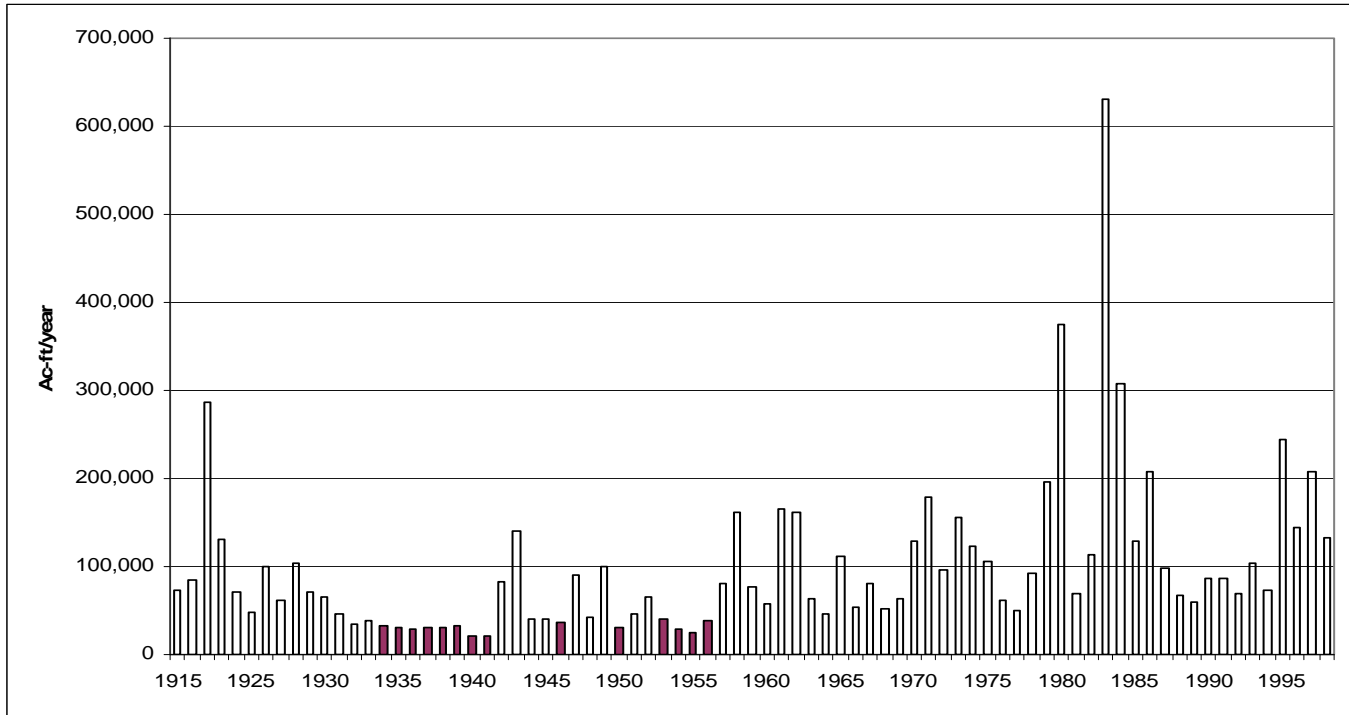


returns for the Greeley gage, with the exception of 1983, a year of exceptionally high spring runoff (Figure 3-8). In addition to direct impacts to river flow at points of diversion and return flows, irrigated agriculture also caused the ground water table to rise; streamside vegetation grows densely along the banks because it is less likely to be destroyed by floods and has a more dependable water supply throughout the year.

Within the study area, the river transitions from a steep, fast flowing, cobble and boulder bed stream occupying most of the width of the canyon floor, to

a narrow, slow flowing, sand and silt bed, lowland stream, dominated by vigorous in-channel vegetation and meandering within a wide floodplain. Within these broad classifications, there are occasional anomalous sub-reaches, often associated with bridge or diversion structures or with channelization, channel straightening or flood protection structures. There are substantial areas of urban and industrial development adjacent to the river (Fort Collins, Windsor and Greeley are the largest) and extensive areas of the floodplain have been (and are presently) mined for gravel.

Figure 3-9. Annual Flow Volumes, Cache la Poudre River near Greeley (USGS gage 06752500), 1903–1998.



Apart from urban and industrial development, open space and parklands, along with the gravel mining activities, adjacent land use is predominantly rural including farming and livestock grazing. Significant in-channel vegetation occurs downstream of Fort Collins, and a narrow band of riparian vegetation exists along the majority of the river in the study area. A dominant feature of the river is a multitude of structures diverting water from the river for municipal and agricultural purposes.

The average bed slope of the Poudre River ranges from 0.0049 feet/ft upstream of Fort Collins to a slope of 0.0015 feet/ft downstream of Windsor. There is a transitional zone of rapidly changing gradient in the vicinity of Fort Collins. In the reach of river downstream of Windsor and upstream of Greeley, there is a zone of elevated bed levels or apparent aggradation.

Bed material size varies through the study area. In general, the size of the bed material reduces from the mouth of the canyon to the confluence of the Poudre and South Platte Rivers. In the upper reaches of the study corridor, the bed material consisted of surface armoring layers and finer sediment within the channel bed. Surface armoring was not evident in the lower reaches of the Poudre River.

Bankfull discharge is “the discharge at which channel maintenance is the most effective, that is, the discharge at which moving sediment, forming and removing bars, forming and changing bends or meanders, and generally doing work that results in the average morphologic characteristics of channels” (Dunne and Leopold 1978). The channel forming discharge is typically associated with the 1.5- to 2-year event.

There is a high variability of bankfull discharge in the upstream part of the study area and a more

Table 3-7. Cache la Poudre River Stream Morphology Study Reaches.

Study Reach Name	Upstream station ¹ (ft)	Upstream limit	Approximate river length (miles)
Laporte Reach	318,573	Munroe Canal	14.45
Fort Collins Reach	242,260	Larimer-Weld Canal	6.96
Timnath Reach	205,510	Fossil Creek inlet	10.59
Windsor Reach	149,580	Whitney Ditch	8.80
Greeley Upstream Reach	103,140	Jones Ditch	7.85
Greeley Channelized Reach	61,690	Colorado and Southern Railway	8.84
Greeley Downstream Reach	14,996	Greeley Gage	2.84

¹Distance upstream of confluence of the Poudre River with the South Platte River.

consistent pattern downstream of Fort Collins. The data also reflect a general trend related to a reduction in the magnitude of the bankfull discharge in the downstream direction. The exception to this trend exists near Greeley in a reach that has been historically modified and channelized.

The study area was divided into seven study reaches that represent zones of similar river character at a broad scale (but that are by no means homogeneous). A summary of the study reaches is provided in Table 3-7. The characterization of each reach is presented in Appendix E, Figures E-1 to E-7.

Common valley morphology predominates in all seven of the stream reaches. The Poudre River valley is a wide, gently sloping valley predominated by Holocene and riverine terraces running along the sides of the valley parallel to the stream. Well-developed floodplains are found adjacent to the river in many places. The terracing and floodplains are indicative of a high sediment supply and riverine depositional processes. The dominant bed form in each of the seven stream reaches is the riffle/pool configuration. A single meandering channel predominates in all of the reaches. There are large, isolated oxbow bends in the Poudre River in the Windsor Reach and in the Greeley Upstream Reach.

Most of the Poudre River in the study area is slightly entrenched. The Fort Collins, Greeley Channelized and Greeley Downstream reaches have been channelized due to past human activities such as gravel mining and levee construction, which has resulted in entrenchment of the channel. These areas are unstable, continually working toward the reestablishment of functional floodplains inside the confines of a continually widening channel.

The streambed through the Laporte and Fort Collins reaches is armored and will remain stable during all but large flood events. During large floods, some channel adjustment would be expected and the armor layer could be disturbed or breached in places, resulting in some instability and bank erosion. In the Timnath through Greeley downstream reaches, the river channel is contracting, meaning that sediment deposition is occurring, the deposited material is being colonized by vegetation and channel margins are encroaching and channel bars forming. Vegetation is able to establish until it is scoured away by high flows.

Table 3-8 provides a tabulation of geomorphic parameters measured at select cross sections along the Poudre River (see Figures E-1 to E-7 in Appendix E for cross section locations).

Table 3-8. Summary of Poudre River Geomorphic Cross Section Data for Cache la Poudre River.

Reach	Cross Section	2-year Discharge	Bankfull Width	Bankfull Depth	Width/Depth Ratio	Width of Flood Prone Area	Entrenchment Ratio	Average Channel Slope	Average Sinuosity	Average Meander Width Ratio	Bed Material	Stream Type
		(cfs)	(ft)	(ft)		(ft)		(ft/ft)			(D50-mm)	
Laporte	265046	1,827	84	4.4	19.2	846	10.1	0.0047	1.11	7.0	209.0	C3
	255598	1,827	103	3.4	30.0	145	1.41	0.0047	1.11	7.0	168.1	F3
Fort Collins	238183	1,542	166	2.1	79.1	179	1.1	0.0037	1.13	4.9	103.0	F3
	206947	1,817	90	6.7	13.5	597	6.6	0.0037	1.13	4.9	56.0	C4
Timnath	198987	1,582	70	4.7	15.1	471	6.7	0.0021	1.34	12.7	94.8	C3
	183254	1,582	97	3.5	27.8	1286	13.2	0.0021	1.34	12.7	38.1	C4
	159000	1,582	125	3.2	39.2	823	6.6	0.0021	1.34	12.7	42.9	C4
Windsor	136450	1,358	100	3.7	27.3	1500	14.9	0.0013	1.58	13.9	1.4	C5
	122435	1,358	100	5.2	19.4	3757	37.4	0.0013	1.58	13.9	27.7	C4
Greeley Upstream	97855	1,358	121	3.3	36.7	3438	28.4	0.0010	1.65	15.1	4.5	C4
	75931	1,353	68	4.6	14.8	4021	59.2	0.0010	1.65	15.1	1.0	C5
Greeley Channelized	50649	1,353	107	4.6	23.1	1500	14.0	0.0015	1.14	7.2	22.3	C4
	48457	1,353	103	2.6	39.2	255	2.5	0.0015	1.14	7.2	45.0	C4
	32153	1,353	78	3.9	19.9	88	1.1	0.0015	1.14	7.2	0.1	F5
Greeley Downstream	12901	1,446	78	3.8	20.7	3083	39.7	0.0012	1.19	11.1	1.2	C5
	6936	1,446	81	4.9	16.6	2879	35.6	0.0012	1.19	11.1	1.2	C5
	3463	1,446	57	3.6	16.0	398	7.0	0.0012	1.19	11.1	1.2	C5

3.5 SURFACE WATER QUALITY

This section provides information on existing surface water quality conditions at key locations relevant to the proposed NISP. This section also addresses potential surface water quality concerns related to project implementation, potential impacts, and cumulative effects. Surface water quality information presented here is summarized based on information contained in the NISP EIS Water Quality Technical Report (ERO and HDR 2008).

3.5.1 Water Quality Standards, Regulations, and Classifications

The Colorado Water Quality Control Commission (CWQCC) adopted water use classifications for streams, lakes, and reservoirs that identify the uses to be protected on a stream segment or in a lake or reservoir. The CWQCC also adopted numerical standards for specific pollutants to protect these uses. The Cache la Poudre River from Shields Street in Fort Collins to the river's confluence with the South Platte River, as well as the South Platte River from the Poudre River to the USGS gage near Kersey, are classified for the following uses:

- Aquatic Life Warm 2 (currently not capable of sustaining a wide variety of warmwater biota, including sensitive species, due to physical habitat, flows, or water quality conditions).
- Recreation 1a (existing or potential primary contact, where the ingestion of small quantities of water is likely to or might occur, such as swimming or kayaking).
- Agriculture (suitable or intended to become suitable for irrigation of crops and not hazardous for livestock drinking water).
- Water supply (suitable or intended to become suitable for potable water supplies

after receiving standard treatment), applies only to the South Platte River.

The Poudre River from the Munroe Canal to Shields Street is classified for the following uses:

- Aquatic Life Cold 2 (currently not capable of sustaining a wide variety of coldwater biota, including sensitive species, due to physical habitat, flows, or water quality conditions).
- Recreation 1a (existing primary contact, where the ingestion of small quantities of water is likely to occur, such as swimming or kayaking).
- Water Supply (suitable or intended to become suitable for potable water supplies after receiving standard treatment).
- Agriculture (suitable or intended to become suitable for irrigation of crops and not hazardous for livestock drinking water).

Horsetooth Reservoir is classified for the following uses:

- Aquatic Life Cold 1 (currently capable of sustaining a wide variety of coldwater biota, including sensitive species).
- Recreation 1a (existing primary contact, where the ingestion of small quantities of water is likely to occur, such as swimming or kayaking).
- Water Supply (suitable or intended to become suitable for potable water supplies after receiving standard treatment).
- Agriculture (suitable or intended to become suitable for irrigation of crops and not hazardous for livestock drinking water).

Numeric standards for the Cache la Poudre River from Shields Street, where its classification changes from Aquatic Life Cold to Aquatic Life Warm, down to the river's mouth, are provided in Table 3-9. Numeric standards for the Cache la Poudre

River from the Munroe Canal to Shields Street are provided in Table 3-10. Numeric standards for Horsetooth Reservoir are provided in Table 3-11. There is no standard for phosphorus; however, the EPA recommends 0.1 mg/L for streams. For lakes or reservoirs, the recommended total phosphorus concentration to prevent or control eutrophication is 0.025 mg/L. Eutrophication is an increase in the biological productivity of a lake or reservoir due to increased nutrient concentrations (generally nitrogen and phosphorus). Eutrophication can result in a decrease in water clarity, reduced dissolved oxygen concentrations, degraded water quality, odors, and decreased fish and other aquatic life populations.

The nonattainment of water quality standards is reported every 2 years in the State's 303(d) list. Stream segments, lakes, or reservoirs on the 303(d) list are considered to be impaired for one or more water quality parameters and a Total Daily Maximum Load (TMDL) effort will need to occur to resolve the impairment. If an impairment is suspected and there are insufficient data to draw a conclusion, the water segment is placed on the Monitoring and Evaluation (M&E) list. The Cache la Poudre River from Boxelder Creek to the South Platte River is on the 2006 303(d) list for selenium and *E. coli*. Horsetooth Reservoir is on the 2006 303(d) list for dissolved oxygen. The Cache la Poudre River from the confluence with the North Fork of the Cache la Poudre River to Shields Street is on the M&E list for aquatic life use.

3.5.2 Potentially Affected Environment

Streams whose water quality could be affected by NISP are the Cache la Poudre River downstream of

the Munroe Canal and the South Platte River downstream of the Cache la Poudre River. These rivers are proposed to be the primary sources of water for NISP. Because Horsetooth Reservoir would be used for NISP water exchange, the water quality of Horsetooth Reservoir could be affected by NISP. The water quality of other streams within the project area would not be affected by NISP and are not discussed in this section.

Within the South Platte River Basin, there are two primary sources of anthropogenic water pollutants: wastewater treatment plant (WWTP) discharges and runoff or subsurface flows from agricultural fields. Discharge from WWTPs is considered a point source of pollution to streams. Treated wastewater effluent can account for a majority of the streamflow and is the primary source of nitrate, ammonia, and phosphorus to Front Range streams (Dennehy et al. 1998). Agricultural runoff to the Cache la Poudre and South Platte rivers is a combination of nonpoint source pollution and point discharges from ditches and pipelines. Another source of pollution is water that percolates into ground water from farm fields and eventually discharges into the streams. Agriculture contributes nutrients, suspended sediments, pesticides, and other pollutants to South Platte River Basin streams. Marine shale deposits on the Front Range are a natural source of metallic and nonmetallic salts to the Cache la Poudre and South Platte rivers (i.e., sulfate, sodium, calcium, and selenium).

Table 3-9. Numeric Standards for the Cache la Poudre River below Shields Street and South Platte River from the Poudre River to the Weld/Morgan County Line.

Parameter	Standard	Parameter	Standard
Physical		Metals¹ (µg/L)	
Dissolved oxygen (mg/L)	5.0	Arsenic (acute)	100
pH	6.5–9.0	Cadmium (total, water supply/total, agriculture)	5/10
Temperature ² (maximum °C)	30	Cadmium (acute, diss/chronic, diss)	3.9/0.58 9.1/1.2
		Chromium III and VI (total, water supply/total, agriculture)	50/100
			794/103
		Chromium III (acute, diss/chronic, diss)	1,773/231
		Chromium VI (diss, acute/chronic)	16/11
Inorganics (mg/L)		Copper (total, water supply/total, agriculture)	1,000/200
Total ammonia ³ (acute/chronic Apr 1 to Aug 31/chronic Sep 1 to Mar 31)	5.6/2.43/2.86	Copper (acute, diss/chronic, diss)	19.7/12.7 49.6/29.3
Unionized ammonia (chronic)	0.10	Iron (chronic, diss, water supply)	300
Chlorine (acute)	0.019	Iron (chronic, total recreation, aquatic)	1,000
Chlorine (chronic)	0.011	Lead (total, water supply/total, agriculture)	50/100
Cyanide	0.005		100/3.9 281/10.9
Sulfide as H ₂ S	0.002	Manganese (total, water supply/total, agriculture)	50/200
Boron	0.75		2,370/1,310 4,738/2,618
Nitrite ⁴	2.7/0.5	Manganese (acute, diss/chronic, diss)	
Nitrate (water supply)	10	Mercury (chronic, total)	0.01
Chloride (water supply)	250	Nickel (water supply, total/agriculture, total)	100/200
Sulfate (water supply)	250		72/200 168/200
		Selenium (water supply, total/agriculture, total)	50/20
		Selenium ⁵ (acute, diss/chronic, diss)	18.4/4.6
		Silver (water supply, total)	100
			4.1/0.64 22/3.5
		Silver (acute, diss/chronic, diss)	
		Zinc (water supply, total/agriculture, total)	5,000/2,000
			201/176
		Zinc (acute, diss/chronic, diss)	464/405

Note: Water supply standards apply only to the South Platte River.

¹Most dissolved aquatics metals standards are hardness dependent; values provided in this table assume a hardness of 150 mg/L for the Cache la Poudre River area in Fort Collins; the second set is for hardness of 400 mg/L for the Cache la Poudre River area east of I-25 and South Platte River near Kersey.

²Chronic temperature standard is the maximum weekly average temperature (MWAT) defined as “the mathematical mean of multiple, equally spaced, daily temperatures over a 7-day consecutive period” (EPA 1977).

³The aquatic life ammonia standards are pH and temperature dependent; an average pH of 8 was used and an average stream temperature of 12 °C was used based on data collected from the Cache la Poudre and South Platte rivers. Ammonia standards are lower when stream temperature and/or pH is higher.

⁴Nitrite standard of 2.7 mg/L is a 30-day average for the Poudre River; standard of 0.5 mg/L is for the South Platte River.

⁵Selenium is a bioaccumulative metal, subject to a range of toxicity values depending on numerous site-specific variables.

Source: CDPHE 2007.

Table 3-10. Numeric standards for Cache la Poudre River from Munroe Canal to Shields Street.

Parameter	Standard	Parameter	Standard
Physical		Metals¹ (µg/L)	
Dissolved oxygen (mg/L)	6.0	Arsenic (acute)	50
Dissolved oxygen, spawning (mg/L)	7.0	Cadmium (acute, diss/chronic, diss/total, water supply)	0.9/0.25/5
pH	6.5–9.0	Chromium III (chronic, diss/total, water supply)	42/50
Temperature ² (maximum °C)	20	Chromium VI (acute, diss/chronic, diss/total, water supply)	16/11/50
		Copper (acute, diss/chronic, diss/total, agriculture)	7/5/200
Inorganic (mg/L)		Iron (chronic, total/water supply, diss)	1,000/300
Total ammonia ³ (acute/chronic for early life stage)	9/3.4	Lead (acute, diss/chronic, diss/total, water supply)	30/1.2/50
Unionized ammonia (chronic)	0.02	Manganese (acute, diss/chronic, diss)	2,370/1,310
Chlorine (acute)	0.019	Manganese (total, water supply/agriculture)	50/200
Chlorine (chronic)	0.011	Mercury (chronic, total)	0.01
Cyanide	0.005	Nickel (acute, diss/chronic, diss/total, water supply)	260/29/100
Sulfide as H ₂ S	0.002	Selenium ⁴ (acute, diss/chronic, diss/total, agriculture)	18.4/4.6/20
Boron	0.75	Silver (acute, diss/chronic, diss/water supply)	0.62/0.02/100
Nitrite	0.05	Zinc (acute, diss/chronic, diss/total, agriculture)	79/69/2,000
Nitrate	10		
Chloride	250		
Sulfate	250		

¹Most dissolved aquatics metals standards are hardness dependent; values provided in this table assume a hardness of 50 mg/L, based on USGS data.

²Chronic temperature standard is the maximum weekly average temperature (MWAT) defined as “the mathematical mean of multiple, equally spaced, daily temperatures over a 7-day consecutive period” (EPA 1977).

³The aquatic life acute ammonia standard is pH and temperature dependent; an average pH of 7.7 was used and an average stream temperature of 9 °C was used based on USGS data. Ammonia standards are lower when stream temperature and/or pH is higher.

⁴Selenium is a bioaccumulative metal, subject to a range of toxicity values depending on numerous site-specific variables.

Source: CDPHE 2007.

Table 3-11. Numeric standards for Horsetooth Reservoir.

Parameter	Standard	Parameter	Standard
Physical		Metals¹ (µg/L)	
Dissolved oxygen (mg/L)	6.0	Arsenic (acute)	50
Dissolved oxygen, spawning (mg/L)	7.0	Cadmium (acute, diss/chronic, diss/water supply, total)	0.5/0.15/5
pH	6.5–9.0	Chromium III (acute, diss/chronic, diss/water supply, total)	183/24/50
Temperature ² (maximum °C)	20	Chromium VI (acute, diss/chronic, diss/water supply, total)	16/11/50
		Copper (acute, diss/chronic, diss/agriculture, total)	3.6/2.7/200
Inorganic (mg/L)		Iron (diss, water supply)	300
Total ammonia ³ (acute/chronic for early life stage)	14.5/4.6	Iron (chronic, total recreation, aquatic)	1,000
Unionized ammonia (chronic)	0.02	Lead (acute, diss/chronic, diss/water supply, total)	14/0.5/50
Chlorine (acute/chronic)	0.019/0.011	Manganese (water supply, total/agriculture, total)	50/200
Cyanide	0.005	Manganese (acute, diss/chronic, diss)	1,881/1,040
Sulfide as H ₂ S	0.002	Mercury (chronic, total)	0.01
Boron	0.75	Nickel (acute, diss/chronic, diss/water supply, total)	145/16/100
Nitrite	0.05	Selenium ⁴ (acute, diss/chronic, diss/water supply, total)	18.4/4.6/50
Nitrate	10	Silver (acute, diss/chronic, diss/water supply, total)	0.19/0.01/100
Chloride	250	Zinc (acute, diss/chronic, diss/agriculture, total)	44/38/2,000
Sulfate	250		

¹Most dissolved aquatics metals standards are hardness dependent; values provided in this table assume a hardness of 25 mg/L, based on City of Fort Collins data.

²Chronic temperature standard is the maximum weekly average temperature (MWAT) defined as “the mathematical mean of multiple, equally spaced, daily temperatures over a 7-day consecutive period” (EPA 1977).

³The aquatic life acute ammonia standard is pH and temperature dependent; an average pH of 7.4 was used and an average stream temperature of 9.5 °C was used based on City of Fort Collins data. Ammonia standards are lower when stream temperature and/or pH is higher.

⁴Selenium is a bioaccumulative metal, subject to a range of toxicity values depending on numerous site-specific variables.

Source: CDPHE 2007.

3.5.2.1 Cache la Poudre River

The water quality of the Cache la Poudre River ranges from nearly pure mountain runoff upstream of Fort Collins to poor quality water east of Fort Collins to the confluence of the South Platte River. The primary source of streamflow in the river is the upper basin, which is largely forested and undeveloped. The quality of the North Fork of the

Poudre River is somewhat poorer than the mainstem, with temperatures that occasionally exceed the standard and elevated dissolved solids concentrations. Below the mouth of the Poudre Canyon, the water in the river is diverted by both municipalities (for municipal and industrial uses) and agriculture (for irrigation). The water is used and reused as it moves downstream, and

contaminants become more concentrated along the way.

3.5.2.2 South Platte River

Except during the late spring to early summer snowmelt runoff period, much of the flow of the South Platte River near Kersey is wastewater discharge to the river and irrigation return flows. In general, the river quality is poor at the Kersey gage.

3.5.2.3 Horsetooth Reservoir

Horsetooth Reservoir supplies water to the City of Fort Collins and several rural domestic suppliers, industries, and agriculture. Water is supplied to the reservoir from the Hansen Feeder Canal primarily by the Colorado-Big Thompson Project via Flatiron Reservoir. The main outlet is through Horsetooth Dam to the Poudre River via the Hansen Supply Canal (NCWCD 2007). The reservoir has stored water since 1951. Manganese concentrations sometimes exceed the secondary drinking water standard of 50 µg/L in Horsetooth Reservoir, most often between August and December. The reservoir is considered to be mesotrophic (contains moderate quantities of nutrients and is moderately productive in terms of aquatic animal and plant life) based on clarity and nutrient concentrations. Horsetooth Reservoir is on the 2006 303(d) list for dissolved oxygen. The USGS has collected many dissolved oxygen measurements during recent years and found very low dissolved oxygen concentrations nearly every year, nearly all between July and October. The low measurements occur in the middle layer of the reservoir, and will require development of TMDLs due to nonattainment of the dissolved oxygen standard (WQCD 2006).

3.5.2.4 Glade Reservoir

The slopes of the Glade Reservoir site are moderate and the drainage is ephemeral; therefore, it is likely

that surface runoff is low, and nutrient and sediment transport is slow. There are no significant continuous surface flows within the watershed of the proposed Glade Reservoir, but during wet weather and especially in wet years, water would be expected to be delivered to the reservoir (Lewis 2003). No water quality data have been collected in the Glade Valley; however, the City of Greeley collected water quality data in a nearby similar watershed from 2000 through 2002. The water is of good quality, although hard, with low nutrient and total organic carbon concentrations (Lewis 2003).

3.5.2.5 Galeton Reservoir

The Galeton Reservoir site is located in a vegetated swale, and contains no defined stream channels. Precipitation that exceeds the soil infiltration rate likely flows only short distances and is retained in small depressions on the site. Water quality at the Galeton Reservoir site would be influenced by the surrounding soils and soil parent material, but because the slopes at the Galeton Reservoir site are very gentle, it is likely that there is little surface runoff, and nutrient and sediment transport is slow. During wet weather and especially in wet years, water would be expected to flow from the upper part of the watershed into the reservoir. Stream water quality data collected near the watershed of the proposed Galeton Reservoir show alkaline water with elevated dissolved solids and nutrient concentrations.

3.5.2.6 Cactus Hill Reservoir

The Cactus Hill Reservoir site is located in the Black Hollow Creek Basin, north of Black Hollow Reservoir. The Black Hollow Creek Basin is a vegetated swale that conveys small amounts of water during and after large precipitation events. Water quality at the Cactus Hill Reservoir site would be influenced by the surrounding soils and soil parent

material, but because the slopes are moderate to low and the drainage is ephemeral, it is likely that surface runoff is low, and nutrient and sediment transport is slow. During wet weather and especially in wet years, water would be expected to flow from the upper part of the watershed into the reservoir. No stream water quality data have been collected in or near the Black Hollow Creek watershed. Part of the Cactus Hill Reservoir site is used as a land application site for wastewater byproducts from the Anheuser-Busch brewing process.

3.6 WATER RIGHTS

The following is a summary of key water rights issues associated with NISP. The District's Poudre and SPWCP conditional water rights are an integral part of the District's Proposed Action and all of the action alternatives. The water rights associated with the NISP alternatives have been described in detail by HDR (2007b).

3.6.1 Regulatory Framework

A water right is the right to use, in accordance with its priority, a portion of the water of the state by reason of the appropriation of the same. Under Colorado's prior appropriation system, a senior water right is entitled to divert the full amount of water to meet the water right before the next junior right is allowed to divert any water. In Colorado, water rights are administered by the Colorado State Engineers Office (SEO) according to the priorities confirmed by the water courts.

3.6.2 Cache la Poudre River Water Rights

The District and Cache la Poudre Water Users Association hold 1980 conditional storage rights on

the Poudre River for the Poudre Project, which include water rights for the Grey Mountain Dam and Reservoir and the Cache la Poudre Forebay Reservoir. The District owns a seven-eighths interest in these conditional rights. The total aggregate storage for these water storage rights is 220,000 AF. NISP would not use the District's entire interest in the Grey Mountain water right.

The District has successfully completed a change of water rights for the Grey Mountain Dam and Reservoir and Cache la Poudre Forebay Reservoir water rights to provide three alternate points of diversion on the Cache la Poudre River and storage in the proposed Glade Reservoir. The Proposed Action would use two of these points of diversion, the Poudre Valley Canal and Munroe Canal. The third decreed point of diversion, the Grey Mountain Reservoir site, is not proposed to be used for NISP. The District has a right to divert up to 2,000 cfs from the Poudre River, but the designed diversion rate for any of the action alternatives varies from 800 cfs when the reservoir is full, to 1,200 cfs when the reservoir is empty, with an average inflow of 1,000 cfs. With a 1980 priority date, the Poudre Project conditional storage rights are very junior water rights, and opportunities to divert are generally limited to years with above-average precipitation and streamflow. The water rights change case applies only to Glade Reservoir. The District would be required to change the water rights to Cactus Hill Reservoir if an alternative involving Cactus Hill Reservoir was selected. It is not known if the District would be successful in changing these water rights to Cactus Hill Reservoir.

3.6.2.1 Modeling of Existing Water Rights

MODSIM, a modeling tool, was used to simulate hydrology for the Poudre Basin, including the historical operation and administration of the major direct flow and storage water rights and the

District's Poudre water rights. As part of the NISP EIS, HDR reviewed the Poudre Basin MODSIM network. The network was examined for inclusion of all key diversions (both agricultural and M&I), storage facilities, exchanges, and other important operational features. Appendices B and C of the NISP Hydrologic Model Review Report include a list of the water rights included in the model network (HDR 2005a).

3.6.3 South Platte Water Conservation Project Water Rights

The District filed applications for conditional water rights for SPWCP in 1992, which were amended in 1997 and 2003. These applications were consolidated into a single case (92CW130). The District-proposed uses of water identified in the applications include all beneficial uses and reuse to extinction. The SPWCP conditional water rights include direct flow and storage rights as well as exchanges up the Cache la Poudre River that will use the Larimer-Weld Canal and the New Cache Ditch, and several reservoirs operated under the umbrella of these ditch companies. The final decree for the SPWCP conditional water rights was signed by the Division 1 Water Judge on November 28, 2005.

The District also has joint interest in a conditional water right for the contemplated Hardin Reservoir site on the lower South Platte River. The Hardin conditional storage right was filed jointly by the District, lower South Platte Water Conservancy District, and Central Colorado Water Conservancy District. No formal partitioning of the storage right has been agreed upon by the holders of the conditional right. While these are still junior water rights (1981 priority) in the overall prior

appropriation system, they are senior to the 1992 SPWCP rights.

As documented in Appendix D of the NISP Alternatives Evaluation Report, HDR determined that NISP would be unlikely to achieve any benefits by transferring a part of the Hardin Reservoir storage decree to the Galeton Reservoir site as a component of the proposed SPWCP (HDR 2007a). As a result, the conditional Hardin water right was eliminated from further consideration. The District abandoned the Hardin water right in 2008.

3.6.4 Environmental Streamflows

As part of the adjudication of the Grey Mountain water right, the District subordinated to three water rights on the Poudre River used for fishery, recreation, and other environmental purposes (Table 3-12). The MODSIM model includes special features that monitor the minimum flows. If necessary, the model will curtail diversions of exchange water into Glade Reservoir in order to make deliveries to meet the Watson fish hatchery, boat chute, or nature center demands.

Table 3-12. Environmental Streamflows Included in the Hydrology Modeling for NISP.

Location	Streamflow Requirement	Purpose
Watson Lake Fish Hatchery	25 cfs (Nov. 1-April 14); 50 cfs (April 15-Oct. 31)	Water to maintain CDOW fish hatchery
Fort Collins boat chute	5 cfs (Sept. 1-April 30); 30 cfs (May 1-Aug. 31)	Used for recreation, piscatorial, fishery, and wildlife habitat
Fort Collins Nature Center	5 cfs (Sept. 1-April 30); 30 cfs (May 1-Aug. 31)	Used for recreation, piscatorial, fishery, and wildlife habitat

For example, the Timnath Reservoir exchange is subject to the Watson and boat chute water rights.

Exchanges from Larimer-Weld Canal, Big Windsor Reservoir, and Terry Lake may be limited by the Watson water rights (RTi 2005). The New Cache Canal is the farthest downstream exchange point, allowing for possible limitations to satisfy the Nature Center water rights. Therefore, exercise of the proposed SPWCP exchanges into the proposed Glade Reservoir will not affect these water rights.

There are no other known environmentally related minimum streamflows that exercise of the Poudre or SPWCP water rights could affect.

3.7 GROUND WATER

This section is a summary of existing ground water resources in the study areas and evaluates whether ground water will be affected by the project-related changes to streamflows and/or the construction of a reservoir at various possible locations. The Ground Water Technical Report (ERO 2007) provides a more detailed discussion of the ground water resources in the project areas.

3.7.1 Glade Reservoir Study Area

The proposed Glade Reservoir study area is underlain by Cretaceous through Pennsylvanian bedrock Formations and Precambrian granite and gneiss. Ground water may exist in fractures in these formations, but productivity is usually very limited. The proposed Glade Reservoir site is located along the Front Range hogback that consists of the upturned edge of these bedrock formations. The hogback areas along the Front Range are typically ground water recharge areas for the bedrock units with ground water generally flowing down dip to the east. If springs and seeps exist in the area, they probably represent local shallow intermittent flow paths.

Relatively thin recent alluvium overlies the bedrock units in the two primary valleys of the reservoir area. The lack of major drainages in the valleys suggests that the alluvium is not a major source of ground water. There may be a saturated zone in the alluvium, perched above the bedrock units, but is probably of limited extent.

Numerous domestic water supply wells exist in the vicinity of the proposed Glade Reservoir footprint, as determined from SEO records. The wells range in depth from 144 feet to 650 feet, with an average depth of about 300 feet. The wells produce water from various bedrock units or the Precambrian granite. Reported production rates are generally less than 10 gallons per minute (gpm), but a few are as high as 30 to 50 gpm. Depth to water in those wells that report water levels is greater than 120 feet below ground surface.

Ground water quality data available from the USGS were for wells located south of the Glade Reservoir site and ranging in depth from 20 to 44 feet. Ground water quality in these wells is characterized as being very hard and somewhat mineralized. A well located north of Horsetooth Reservoir had very high nitrate and high iron concentrations. The sources of these contaminants are the local sedimentary bedrock formations and seepage of agricultural irrigation water into ground water.

3.7.2 Cactus Hill Reservoir Study Area

The Cactus Hill Reservoir study area geology consists of Upper Cretaceous sandstones and shales overlain by thin (0 to 15 feet) Quaternary alluvium, weathered bedrock, and wind deposited sands and silts. Ground water occurs in the sandstones and fractured shales of the Pierre Shale and Fox Hills Formation. The thin Quaternary deposits are most

likely dry, but may contain ground water during periods of heavy precipitation or locally where ground water is perched on the shales.

The well records of the SEO indicate that with only a few exceptions, all domestic and stock wells are greater than 100 feet deep and most are greater than 600 feet deep. Well records indicate that there are a few wells that produce water from depths of between 20 and 80 feet.

Ground water quality data available from the USGS were for wells located southeast or southwest of the Cactus Hill Reservoir site and ranging in depth from 15 to 150 feet. Ground water quality in these wells is characterized as being high in dissolved solids (particularly the shallower wells), very hard and with high sulfate concentrations. One of the wells had a high nitrate concentration and one had a high selenium concentration. The sources of these contaminants are the local marine or shoreline sedimentary bedrock formations and seepage of agricultural irrigation water into ground water.

3.7.3 Galeton Reservoir Study Area

The Galeton Reservoir study area geology consists of Upper Cretaceous shales and sandstones of the Laramie Formation. The bedrock units are overlain by 0 to 12 feet of Quaternary alluvium, residual bedrock, and wind deposited sands and silts. Ground water occurs in the sandstone units, and possibly fractured shales, of the Laramie Formation. The thin Quaternary deposits are probably dry, except where thin saturated zones may be perched on underlying shales.

The well records of the SEO indicate that there are few wells in the Galeton Reservoir study area. The domestic and stock wells produce water from bedrock units, as deep as 367 feet and depth to water

is about 100 feet or deeper. One domestic well produces water from a well 41 feet deep.

Ground water quality data available from the USGS were for wells located east or southeast of the Galeton Reservoir site and ranging in depth from 25 to 32 feet. Ground water quality in these wells is characterized as being high in dissolved solids, extremely hard and with very high sulfate concentrations. One of the wells had a high nitrate concentration. The sources of these contaminants are the local marine or shoreline sedimentary bedrock formations and seepage of agricultural irrigation water into ground water.

3.7.4 Cache la Poudre and South Platte River Corridors

Along the Poudre River corridor, the thickness of unconsolidated sediments ranges from about 20 feet between the foothills and west of Greeley, then increases in thickness to about 40 feet under Greeley and up to 100 feet thick east of Greeley in the Poudre and South Platte River corridors (Robson et al. 2000). The yield from alluvial wells is generally less than 500 gpm, but wells east of Greeley may produce up to 1,500 gpm. The alluvial wells have high concentrations of dissolved solids, which include high metal and sulfate concentrations. Some wells also have high nitrate/nitrite concentrations (Hillier and Schneider 1979; Dennehy et al. 1995). The sources of these contaminants are the local marine or shoreline sedimentary bedrock formations and infiltration of agricultural irrigation water to ground water. Ground water is a major nonpoint source of nitrate and dissolved solids to the lower reaches of the South Platte River. Nitrate concentrations can be greater in ground water than surface water because microbial activity in streambed sediments will remove nitrate (Dennehy et al. 1995).

3.8 GEOLOGY

This section presents a summary of the existing geological resources in the NISP study area. These resources could be affected by construction activities at any of the reservoir locations and the potential sites for the relocation of U.S. 287. More detailed information is available in the Geological Technical Memorandum Review (GEI 2006a, 2006b, 2006c).

3.8.1 Glade Reservoir Study Area

The Glade Reservoir study area is located in the Southern Rocky Mountains physiographic province near the border of the Great Plains physiographic province to the east. Uplift, faulting, folding, and erosion from Laramide time (Late Cretaceous) through late Pliocene time have modified the topography to its present configuration. The Front Range, the easternmost range of the Southern Rocky Mountain system, extends from the Colorado-Wyoming state line to the Arkansas River. The oldest rocks in the region are Precambrian metamorphic (metasedimentary and metavolcanic), and intrusive (granitic) rocks. In general, these rocks consist of schists, gneisses, and granites of the Idaho Springs Formation. Overlying the Precambrian rocks are mostly late Paleozoic to Mesozoic sandstones, shales, and limestones of continental and marine origin. The proposed Glade Reservoir and dam site is located primarily in the valleys within these folded and faulted Paleozoic sedimentary rocks. Quaternary alluvium deposits up to 40 feet thick cover the floors of the valleys formed by the uplifted Paleozoic sedimentary rocks.

The bedrock units at the Glade Reservoir site include Precambrian metamorphic and granitic rocks occurring in the upper part of the right abutment, faulted against Lykins siltstone in the right portion of the valley section. The central valley section

consists primarily of Sundance and Jelm sandstone (overlain by Quaternary alluvium), and the steep part of the left abutment contains the Morrison shales and sandstones. The upper left abutment extension consists of two units of the Dakota Group mapped as the Lytle Formation conglomeritic sandstone and the South Platte Formation shales and sandstones (GEI 2006a).

The Lykins Formation, found at the base of the right abutment, is estimated to be approximately 800 to 1,000 feet thick in the Colorado-Wyoming area. The Lykins Formation has been the subject of several geotechnical investigations at nearby Horsetooth Reservoir involving reservoir seepage through one or more of its limestone, gypsum, or anhydrite subunits contained in the lower 250 feet. During construction of the Horsetooth Reservoir, voids and joints within the Sundance Sandstone Formation, identified in the central valley section of the Glade Reservoir site, were suspected of diverting drilling waters during foundation grouting. These voids and soft siltstone and clays were overexcavated during the foundation construction (GEI 2006a).

Surface geology within the central valley section consists of up to 40 feet of undifferentiated Quaternary alluvial and colluvial material. Alluvium consists of red to reddish-brown silty/clayey sands and gravels. Colluvial material consists of silt to cobble-sized material derived primarily from upslope mass wasting and landslide deposits (Braddock 1998; GEI 2006a).

Numerous north-northwest to south-southeast-trending faults bisect the region. Three of the more prominent faults proximate to the proposed Glade Reservoir site are the Bellvue Fault, the Livermore Fault, and the North Fork Fault. All of the faults in the vicinity of the Glade Reservoir site are considered inactive (Braddock 1988; GEI 2006a). The southern end of the North Fork Fault is mapped

as intersecting the proposed dam axis in the right valley section and terminates north of the proposed Glade Reservoir dam site (Braddock et al. 1988a).

The northern end of the Bellvue Fault terminates north of the proposed Glade Reservoir dam site with two related fault splays suspected to be near the left abutment and spillway. The Bellvue Fault consists of a steeply easterly dipping reverse fault likely responsible for the offset of the sedimentary strata located north of the left abutment of the proposed main dam axis (Braddock et al. 1988a).

3.8.2 Cactus Hill Reservoir Study Area

The Cactus Hill Reservoir study area is located on the Upland Subsection area between Cache la Poudre Valley and the Eaton-Ault mantled lowland of the Colorado Piedmont Section of the Great Plains Province. This upland surface is scored by closely spaced, mostly shallow valleys that trend southeastward. This section is characterized by a dominance of Upper Cretaceous sandstone rock units. The Piedmont Section is located between the Front Range of the Southern Rocky Mountains and the High Plains to the east. The Colorado Piedmont is an area where the South Platte River and its tributaries have stripped away a cover of sedimentary rock that once was continuous with rocks of the High Plains region. The Piedmont surface is much lower and less rugged than the Front Range surface, but generally more irregular than the less eroded surface of the western High Plains. The elevations in the Piedmont generally decrease gradually to the southeast (GEI 2006c).

The geology of the proposed Cactus Hill Reservoir and dam area generally consists of 0 to 15 feet of Quaternary surficial soils overlying Cretaceous bedrock. The surficial soils generally consist of

poorly to moderately consolidated alluvium, residual bedrock, and wind deposited sands and silts. The bedrock consists of gently dipping sedimentary rocks. The regional bedrock structure dips gently to the east and northeast, usually less than 10 degrees. No faults have been mapped in the Cactus Hill site vicinity.

The bedrock in the study area consists primarily of Upper Cretaceous sandstones and shales. The upper member of the Pierre Shale occurs in the right abutment and most of the west half of the proposed Cactus Hill Reservoir area. This upper unit is known as the transition member of the formation and consists of soft gray to light gray shales and sandy shales with occasional limestone beds and sandstone layers. The lower member of the Fox Hills Formation contacts the Pierre Shale and occurs in the left abutment and most of the eastern side of the reservoir area. The Lower Member consists of light gray to light brown, interbedded, silty sandstone and sandy shale (GEI 2006c).

3.8.3 Galeton Reservoir Study Area

The Galeton Reservoir study area is located on the Upland Colorado Piedmont Section of the Great Plains Province. This upland surface is scored by closely spaced, mostly shallow valleys that trend southeastward. This section is characterized by a dominance of Upper Cretaceous shales and sandstone rock units. The Piedmont Section is located between the Front Range of the Southern Rocky Mountains and the High Plains to the east.

The geology of the proposed dam and reservoir area generally consists of 0 to 12 feet of Quaternary surficial soils overlying Cretaceous bedrock. The surficial soils are generally poorly to moderately consolidated alluvium, residual bedrock, and wind deposited sands and silts (Braddock and Cole 1978).

The bedrock consists of gently dipping sedimentary rocks. The regional bedrock structure dips gently to the east and northeast, usually less than 10 degrees. No faults have been mapped in the Galeton Reservoir site vicinity.

The Laramie Formation is mapped as the bedrock unit at the Galeton Reservoir site and it is composed of sandstones, siltstone, and claystones. Coal beds and a few thin ironstones may be found near the base of the lower part of the Laramie. The sandstones of the Laramie Formation are medium grained, light gray, and massive to thin bedded. They are poorly cemented throughout and are often soft and friable. They may have clay filling the interstices between grains rather than quartz cement (GEI 2006c).

3.8.4 Pipeline Corridors

Glade to Horsetooth Pipeline. The Glade to Horsetooth pipeline would extend from Glade Reservoir south to Horsetooth Reservoir. Surface geology generally consists primarily of poorly sorted, Quaternary deposits from erosion, landslides, rockfalls, or other mass wasting processes with alluvial deposits of silts to boulders within the river and stream valleys. In general, bedrock geology beneath Quaternary deposits consists of north-northwest-trending Permian and Lower Triassic sedimentary units. Laramide uplift, folding and faulting to the west tilted the formations to between 20 and 30 degrees to the east-northeast. Erosion of the Colorado Piedmont resulted in north-northwest trending valleys, ridges and hogbacks.

Bedrock geology within the northern portion of the pipeline corridor consists of reddish Lykins Formation siltstones and sandstones with carbonate layers within the lower subunits. South of the Cache la Poudre River, bedrock geology within the pipeline corridor consists of the north-northwest-trending Lykins Formation overlain by Quaternary valley fill

alluvium and surface soils (Braddock et al. 1988a). In the southern portion of the pipeline corridor, the corridor repeatedly crosses portions of the Lyons and Owl Canyon Formations as well as the Lykins Formation. The Lyons Formation is a 20- to 50-foot-thick, well cemented, red quartz sandstone with the younger Lykins Formation to the east. West of the Lyons Formation, the pipeline crosses the upper Owl Canyon Formation, a 200-foot-thick red siltstone and sandstone formation (Braddock et al. 1989).

The pipeline corridor crosses two mapped faults—Bellvue and Rist Canyon. The southern extension of the Bellvue Fault is located to the east of the proposed pipeline route and is mapped as inactive. The proposed pipeline corridor also crosses an extension of the inactive Rist Canyon Fault at Empire Gulch (USGS 2005; Morgan 2007).

Cactus Hill to Horsetooth Pipeline. The Cactus Hill to Horsetooth pipeline corridor crosses the Upland Subsection area between the Cache la Poudre Valley to the west and the Eaton-Ault mantled lowland of the Colorado Piedmont Section of the Great Plains Province to the east. The eastern portion of the corridor crosses closely spaced, shallow southeastward-trending valleys and is characterized by Upper Cretaceous sandstone rock units overlain by Quaternary alluvial and windblown sediments. The western portion, west of the Cache la Poudre River, is characterized by Pleistocene poorly to moderately sorted alluvial sediments overlying steeply eastwardly dipping Cretaceous sedimentary Formations.

The geology of the eastern portion of the proposed Cactus Hill to Horsetooth pipeline corridor is similar to that of the proposed Cactus Hill Reservoir study area, generally consisting of 0 to 15 feet of Quaternary surficial soils overlying Cretaceous bedrock. The surficial soils generally consist of

poorly to moderately consolidated alluvium, residual bedrock, and wind-deposited sands and silts. The bedrock consists of sedimentary sandstones and shales gently dipping to the east and northeast at generally less than 10 degrees in the eastern portion of the pipeline corridor. The pipeline corridor crosses the upper transition member of the Pierre Shale, east of Boxelder Creek. This unit consists of soft gray to light gray shales and sandy shales with occasional limestone beds and sandstone layers. Lower Members of the Pierre Shale Formation outcrop west of Lindenmeier Lake, before the corridor crosses Quaternary alluvium within the Cache la Poudre River valley (GEI 2006c).

West-southwest of the Cache la Poudre River, the pipeline corridor crosses increasingly older sedimentary formations tilted to the east during the Laramide uplift of Pre-Cambrian rocks to the west. The western terminus of the pipeline corridor is marked by the increasingly steeper dip, up to 50 degrees, of formations that comprise the east bank of Horsetooth Reservoir. These consist of Cretaceous shales and limestones, Pierre Shale, Niobrara, and Carlile Formations, and the sandstones and siltstones of the Dakota Group. The Bellvue Fault, a high-angle thrust fault within the Cretaceous Dakota Group of sandstones and shales, has been mapped at the western terminus of the pipeline corridor (Braddock et al. 1989; USGS 2005).

Carter Pipeline. The Carter pipeline extends from the proposed Glade Reservoir south, around the east side of Horsetooth Reservoir, south to Carter Lake where it would tie into the existing SWSP. The proposed pipeline route generally follows the north-south-trending strike of the uplifted Paleozoic and Mesozoic sedimentary rock units of the Southern Rocky Mountain province. Quaternary rock falls, landslides, and other mass wasting depositional processes have covered a major portion of the

bedrock geology with unconsolidated deposits up to 25 feet thick.

The surface and bedrock geology of the northern portion of the Carter pipeline corridor, between Glade Reservoir and Horsetooth Reservoir, is similar to that of the proposed Glade to Horsetooth pipeline corridor. Immediately north of Horsetooth Reservoir, the proposed Carter pipeline turns east, crossing increasingly younger sands and shales of the Sundance Formation, claystones and siltstones of the Morrison Formation, the grey to tan shales and sandstones of the Dakota Group, and the marine sediments of the Carlile Shale, Greenhorn Limestone, and Graneros Shale. The proposed pipeline corridor crosses the southern extension of the Bellvue Fault, a north-south-trending inactive thrust fault locally within the Cretaceous Dakota Group (Braddock et al. 1989).

Between the north end of Horsetooth Reservoir and the Big Thompson River, bedrock geology in the proposed pipeline corridor primarily consists of the Cretaceous Carlile Shale/Greenhorn Limestone/Graneros Shale group, also referred to as “Benton Group” on older maps (Braddock et al. 1970), uplifted to the west by Laramide-related folding and faulting. After traversing the eastern flank of the Big Thompson Anticline (fold), the pipeline route crosses the southern nose of the southeasterly-plunging anticline east of Boedecker Lake. Between Boedecker Lake and the southern end of the pipeline corridor, the east-west trending portions of the pipeline route cross Cretaceous sedimentary units (Carlile Shale/Greenhorn Limestone/Graneros Shale, Niobrara Formation and Pierre Shale) folded into north-northeasterly plunging anticlinal/synclinal structures exposed in repeated sequences. Bedrock geology of the north-south-trending portions of the corridor consists primarily of the east-dipping Niobrara, Lyons, and Lykins Formations on the east flank of the Carter Lake Anticline. Bedrock geology

at the southern terminus of the Carter pipeline consists of the southern plunging nose of the Carter Lake Anticline, exposing the Lykins siltstone and fine grain, reddish sandstones (Braddock et al. 1988a, 1989).

Surface geology along the pipeline corridor is characterized by Quaternary alluvial and gravel deposits on former terraces and pediments associated with eastward-trending surface water drainages. North of the Big Thompson River, the proposed pipeline corridor shifts to the east for 3 miles, crossing the cobbly and bouldery gravels of the Slocum Alluvium, associated with Pleistocene glacial runoff. The Slocum Alluvium, up to 20 feet thick, is generally found on the upland areas with a well-developed soil horizon. Eastward-trending incised stream valleys expose Cretaceous Pierre Shale bedrock in these areas (Braddock et al. 1988a, 1989).

Three inactive faults cross the proposed pipeline corridor between Horsetooth Reservoir and the Big Thompson River. The two northern faults are extensions of the Buckhorn Creek Fault, primarily located west of Horsetooth Reservoir. The southern fault is a small (less than 0.5-mile mapped distance) unnamed fault in Section 21, Township 6 North, Range 69 West, with little mapped offset (Braddock et al. 1970). Several small, east-west-trending inactive faults are mapped in exposed bedrock units east of the southern portion of the pipeline corridor (Section 31, Township 5 North, Range 65 West). North of Dry Creek, the pipeline corridor crosses a northwesterly-trending, unnamed inactive reverse fault. Movement along this southern fault likely caused the offset in sedimentary units, resulting in bedrock geology at the southern terminus of the pipeline corridor dominated by folded and faulted, easterly dipping Cretaceous Dakota Formation shales (Braddock et al. 1988b).

SPWCP Pipelines. Geology within the Galeton Reservoir/SPWCP pipeline corridors consists of Upper Cretaceous shales and sandstones of the Laramie Formation. Laramie Formation shales are characterized by yellow-gray to brown, nonmarine carbonaceous shales and kaolinitic claystone and have a gently (10 degrees or less) dip to the east. The bedrock units are overlain by 0 to 12 feet of Quaternary alluvium, residual bedrock, and wind-deposited sands and silts (Braddock and Cole 1978). No faults have been mapped within the Galeton Reservoir/SPWCP pipeline corridor (USGS 2005).

3.9 SOILS

This section provides a summary of the existing soils within the NISP study area that may be affected by construction of reservoirs, forebays, or due to the agricultural lands transfer under Alternative 4. More detailed information on soils is provided in the Land Use Technical Report (ERO 2008g).

Descriptions of the soils in the three reservoir study areas and the U.S. 287 realignment study area are based on the NRCS soils surveys of Larimer and Weld counties (NRCS 1980, 1982a). The NRCS-mapped soil types in the Glade, Galeton, and Cactus Hill study areas, as well as the U.S. 287 study area were assessed to determine if they are Prime Farmland soils or soils that would be Prime Farmland if they were irrigated, as determined by the NRCS in the Important Farmland Inventory (NRCS 1982b). Prime Farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses (NRCS 1982b).

3.9.1 Glade Reservoir Study Area

In the Glade Reservoir study area, soils on the hogbacks generally are Purner fine sandy loams, hilly haplustolls, and rock outcrops. Purner fine sandy loams are well-drained soils formed in material weathered from reddish brown sandstone. Hilly haplustolls occur on mountainsides and fans, and have extremely variable soil texture, ranging from sandy loam to loam to clay loam. The haplustolls and Purner fine sandy loams include areas of rock outcrops.

Valley bottom soils generally are Santana loam, Poudre fine sandy loam, Harlan fine sandy loam, and Heldt clay loam. The Santana loam is deep and well drained, and is formed from mixed alluvium and colluvium. The Poudre fine sandy loam consists of deep, somewhat poorly drained soils that formed in alluvium on terraces, floodplains and drainageways. The Harlan fine sandy loam occurs on terraces, fans, and valleysides, and consists of deep, well-drained soils that formed from weathered alluvium, sandstone, and shale. Soil texture ranges from fine sandy loam to loam to sandy clay loam. Heldt clay loam is a deep, well-drained soil that formed in alluvium from clay shale. Soil texture ranges from clay loam to silty clay loam.

NRCS soil mapping units in the Glade Reservoir study area that were identified as potential Prime Farmlands if irrigated are Santana loam and the Santana variant loam, Harlan fine sandy loam, and Heldt clay loam. The Connerton-Barnum complex is present in the Glade Reservoir study area and is considered a Prime Farmland soils even if not irrigated.

3.9.2 Cactus Hill Reservoir Study Area

The soils at the Cactus Hill Reservoir study area include mainly Terry sandy loam and Ascalon fine sandy loam, with areas of Platner loam and other soil types. Terry sandy loam is moderately deep and well drained, formed from calcareous and sandy residuum derived from sandstone. Ascalon fine sandy loam is a deep, well-drained soil that formed in calcareous loamy alluvium. Platner loam is deep and well drained, formed from calcareous alluvium (NRCS 1982a).

Soil mapping units identified as potential Prime Farmlands in the Cactus Hill Reservoir study area are Ascalon fine sandy loam and Platner loam. No soils would be potential Prime Farmland soils if irrigated in the Cactus Hill Reservoir study area.

3.9.3 Galeton Reservoir Study Area

Most of the Galeton Reservoir is Manzanola clay loam, a deep, well-drained soil on plains swales and stream terraces. Manzanola clay loam formed in calcereous clayey alluvium. Other soil types in the Galeton Reservoir study area include Olney fine sandy loam, Platner loam, Renohill loam, and Terry sandy loam. All of these soils formed from calcareous alluvial deposits. Soil texture ranges from loam to fine sandy loam to sandy loam except Renohill loam and Terry loam, which formed from calcareous sandstone (NRCS 1982a).

Soil mapping units considered as potential Prime Farmlands in the Galeton Reservoir study area are Olney fine sandy loam and Platner loam. There were no soils that would be potential Prime Farmland soils if irrigated in the Galeton Reservoir study area.

3.9.4 Agricultural Transfer Lands Study Area

Soils in portions of the Agricultural Transfer Lands study area that are supplied by the New Cache Ditch are Nunn clay loam, Olney fine sandy loam, Kim loam, and Otero sandy loam. All of these soils are deep, well-drained soils of the plains, formed from alluvium and Aeolian deposits, or outwash.

Soils in the portion of the Agricultural Transfer Lands study area that are supplied by the Larimer and Weld Canal include Ascalon sandy loam, Fort Collins loam, Garrett loam, Nunn clay loam, Santana variant clay loam, Loveland clay loam, Otero sandy loam, Kim loam, Santana loam, Thadalund loam, Table Mountain loam, Stoneham loam, and Tassal sandy loam.

In the Agricultural Transfer Lands study area, potential Prime Farmlands supplied by the New Cache Ditch include Olney fine sandy loam, and Nunn clay loam, 0 to 6 percent slope. Soil mapping units supplied by the New Cache Ditch that are potential Prime Farmlands if irrigated are Nunn clay loam with greater than 6 percent slope, Kim loam, and Otero sandy loam.

Potential Prime Farmlands supplied by the Larimer and Weld Ditch include Nunn clay loam with less than 6 percent slope, Stoneham fine sandy loam, and Otero sandy loam. Soil mapping units that are potential Prime Farmlands if irrigated include Santana Variant clay loam, Ascalon sandy loam, Fort Collins loam, Garrett loam, Nunn clay loam with greater than 6 percent slope, Loveland clay loam, Otero sandy loam, Kim loam, Santana loam, and Table Mountain loam.

3.10 VEGETATION

The following is a summary of the vegetation resources in the study areas. The Vegetation Technical Report provides a more detailed description of the vegetation resources evaluated in the NISP study areas (ERO 2008a). Wetland vegetation cover types (palustrine persistent emergent, and palustrine scrub-shrub wetlands) are discussed in the Wetlands and Other Waters section of this chapter.

The vegetation types in the NISP study areas were classified according to the dominant life forms (such as grasses, shrubs, or trees), dominance by native or introduced species, and moisture regime. Table 3-13 through Table 3-16 show the vegetation cover types at the U.S. 287 realignment, Glade Reservoir, Galetton Reservoir, and Cactus Hill Reservoir study areas.

This section also discusses State of Colorado-listed noxious weeds found in the study areas. Noxious weeds are defined as plant species that are not indigenous (nonnative) to the State of Colorado and meet at least one of several criteria regarding their negative impacts upon crops, native plant communities, livestock, and the management of natural or agricultural systems.

Table 3-13. Vegetation Cover Types—U.S. 287 Realignment Study Area.

Vegetation Cover Type	Western Alignment Area (acres)	Northern Alignment Area (acres)
Upland native grasslands	595.70	1,309.7
Upland mixed grasslands	452.67	452.8
Upland introduced grasslands	--	--
Mesic native grasslands	13.20	16.3
Mesic mixed grasslands	53.99	49.0
Upland native shrublands	427.97	1,027.0
Mesic native shrublands	12.19	12.2
Mesic mixed shrublands	1.04	1.0
Upland native woodlands	--	--
Mesic mixed woodlands	16.59	50.6
Agricultural lands	--	103.5
Revegetated areas	715.59	783.6
Disturbed areas	46.83	51.6
Landscaped areas	--	--
Roads	5.12	--
Palustrine persistent emergent wetlands	23.51	22.6
Palustrine scrub-shrub wetlands	2.92	2.7
Other waters (ponds, reservoirs, and lakes)	9.97	12.7
Other waters (creeks, streams, ditches, and canals)	14.11	22.8
Total	2,391.40	3,918.1

Table 3-14. Vegetation Cover Types—Glade Reservoir Study Area.

Vegetation Cover Type	Area in Study Area (acres)
Upland native grasslands	898.2
Upland mixed grasslands	22.0
Upland introduced grasslands	2.2
Mesic native grasslands	60.8
Mesic mixed grasslands	78.9
Upland native shrublands	516.0
Mesic native shrublands	30.2
Mesic mixed shrublands	55.9
Upland native woodlands	0.5
Mesic mixed woodlands	25.1
Agricultural lands	264.9
Revegetated areas	--
Disturbed areas	63.0
Landscaped areas	--
Roads	86.8
Palustrine persistent emergent wetlands	45.3
Palustrine scrub-shrub wetlands	--
Other waters (ponds, reservoirs, and lakes)	0.6
Other waters (creeks, streams, ditches, and canals)	5.7
Total	2,156.1

Table 3-15. Vegetation Cover Types—Cactus Hill Reservoir Study Area.

Vegetation Cover Type	Area in Study Area (acres)
Upland native grasslands	882.3
Upland mixed grasslands	2,634.6
Upland introduced grasslands	--
Mesic native grasslands	3.9
Mesic mixed grasslands	168.4
Upland native shrublands	--
Mesic native shrublands	--
Mesic mixed shrublands	--
Upland native woodlands	--
Mesic mixed woodlands	15.1
Agricultural lands	688.1
Revegetated areas	--
Disturbed areas	106.1
Landscaped areas	--
Roads	--
Palustrine persistent emergent wetlands	46.4
Palustrine scrub-shrub wetlands	<0.1
Other waters (ponds, reservoirs, and lakes)	5.3
Other Waters (creeks, streams, ditches, and canals)	2.8
Total	4,553.0

Table 3-16. Vegetation Cover Types—Galeton Reservoir Study Area.

Vegetation Cover Type	Area in Study Area (acres)
Upland native grasslands	1,849.0
Upland mixed grasslands	428.5
Upland introduced grasslands	204.1
Mesic native grasslands	--
Mesic mixed grasslands	144.4
Upland native shrublands	--
Mesic native shrublands	--
Mesic mixed shrublands	--
Upland native woodlands	--
Mesic mixed woodlands	--
Agricultural lands	155.0
Revegetated areas	--
Disturbed areas	--
Landscaped areas	--
Roads	--
Palustrine persistent emergent wetlands	3.8
Palustrine scrub-shrub wetlands	--
Other Waters (ponds, reservoirs, and lakes)	5.6
Other Waters (creeks, streams, ditches, and canals)	5.5
Total	2,795.9

3.10.1 Regulatory Framework

Vegetation resources in general are not regulated by state or federal agencies, although federally listed threatened and endangered plant species are protected under the Endangered Species Act, as described in the Species of Concern section. Certain actions affecting riparian resources are regulated by the Colorado Division of Wildlife (CDOW), as discussed in the Riparian Resources section. Certain actions affecting wetlands may be regulated by the Corps under the Clean Water Act, as discussed in Wetlands Section 3.12.

3.10.2 Grasslands

Grasslands occur in all of the study areas, and were grouped according to moisture regime (mesic or upland) and species origin (native, introduced, or mixed). The quality of vegetation types was qualitatively evaluated based on the presence of native species rather than introduced, the level of past disturbance, and the uniqueness in the area.

3.10.2.1 Upland Native Grasslands

Upland native grasslands occur in all of the NISP study areas. These grasslands are dominated by native species such as blue grama, needle and threadgrass, western wheatgrass, and fringed sage. Nonnative species, such as cheatgrass and other weeds, are present, but generally are not dominant. In foothill areas, patches of mountain mahogany or other upland shrubs may occur in this vegetation type.

Of the grassland vegetation types, upland native grasslands are considered to be of high quality because they are dominated by native species, have been subjected to less disturbance than other grassland types (such as upland introduced

grassland), and provide examples of natural prairie or prairie-foothill environments.

3.10.2.2 Upland Mixed Grasslands

Upland mixed grasslands are dominated by a mixture of native and nonnative species. This is the most extensive vegetation cover type in the Cactus Hill Reservoir study area, and is also found in the U.S. 287 realignment, Glade Reservoir, Galetton Reservoir, the Poudre Valley Canal, and all of the pipeline study areas. Upland mixed grasslands may contain areas of Conservation Reserve Program (CRP) lands, which are areas that were in cultivated agricultural production in the past, but have been retired and reseeded with native or introduced species.

Upland mixed grasslands contain a variety of species including western wheatgrass, blue grama, intermediate wheatgrass, smooth brome, cheatgrass, and redroot pigweed. The upland mixed grasslands in the study area are low quality. Generally these areas have been disturbed by activities such as tilling, hay production, or heavy grazing, and may contain noxious weeds.

3.10.2.3 Upland Introduced Grasslands

Upland introduced grasslands are dominated by species not native to North America. Upland introduced grasslands include areas that have been disturbed in the past by heavy grazing, tilling, hay production, and other physical disturbances. In many cases, upland introduced grasslands were seeded with introduced species such as smooth brome or crested wheatgrass. The upland native grassland type is considered to be of low quality because of past physical disturbance, and the dominance of introduced species.

3.10.2.4 Mesic Native Grasslands

Mesic native grasslands occur in the Glade Reservoir and U.S. 287 realignment study areas. In areas that were mapped remotely, mesic native grasslands also may be included in areas mapped as potential wetlands or mesic mixed grasslands. Mesic mixed grasslands occur in moist to wet drainage swales and valleys. Western wheatgrass is the dominant grass, along with green needle grass and other native species. Mesic native grasslands are typically of moderate quality. These areas have been grazed in the past and contain some weeds.

3.10.2.5 Mesic Mixed Grasslands

Mesic mixed grasslands occur in moist swales and depressions in areas that have had moderate to high levels of surface disturbance (such as tilling, grazing, grading, or hay production). In areas mapped remotely, mesic mixed grasslands may be included in areas mapped as wetlands. A mix of introduced and native species dominates the mesic mixed grasslands. At the Glade Reservoir and U.S. 287 realignment study areas, western wheatgrass, snakeweed, and Kentucky bluegrass are dominant. Noxious weeds such as field bindweed and Dalmatian toadflax also are common. At the Galetton Reservoir study area, buffalograss, western wheatgrass, rubber rabbitbrush, Kochia, and Russian thistle are the dominant species. At the Cactus Hill Reservoir study area, mesic mixed grasslands are dominated by smooth brome, field bindweed, saltgrass, and western wheatgrass. The mesic mixed grasslands also include irrigated hay lands in the No Action study areas and Agricultural Transfer Lands study area.

The mesic mixed grasslands are of low quality. Mesic mixed grasslands contain weeds such as bindweed and cheatgrass, and have been disturbed by historical grazing, tilling, or grading.

3.10.3 Shrublands

Shrublands occur in the study areas within the foothills, such as the Glade Reservoir, U.S. 287, and Glade to Horsetooth pipeline and Carter pipeline study areas, and in riparian areas along creeks and streams, and around stock and irrigation ponds. Because of their structural diversity, shrublands typically provide good quality wildlife habitat.

3.10.3.1 Upland Native Shrublands

Upland native shrublands are common along hogbacks and ridges within the Glade Reservoir, U.S. 287 realignment, and Glade to Horsetooth pipeline study areas. Patches of shrublands also occur in the Carter pipeline study area. Mountain mahogany is the dominant species, and skunkbush is common as well. The understory contains species such as blue grama, needlegrass, fringed sage, prickly pear cactus, and cheatgrass. Ponderosa pines are scattered along the upper portions of the ridges.

In the U.S. 287 realignment study area, the CNHP-tracked Bell's twinpod is common in the understory along the hogback east of the Holcim Mine. This species also may occur in upland native shrublands in the Carter pipeline study area.

Three vegetation communities tracked by the CNHP occur within the upland native shrubland vegetation cover type: 1) mixed foothills shrublands, dominated by needle-and-threadgrass, have been recorded in the Glade Reservoir and U.S. 287 realignment study areas; 2) foothills shrublands, dominated by mountain mahogany and New Mexico needlegrass, occur in the Glade Reservoir study area; and 3) mixed mountain shrublands, dominated by mountain mahogany with mountain muhly in the understory, occur in the U.S. 287 realignment study area (ERO 2008a).

The upland native shrubland vegetation type is of high quality. Except for some mining and grazing in the U.S. 287 realignment study area, this vegetation cover type generally has received little disturbance in the past.

3.10.3.2 Mesic Native Shrublands

The mesic native shrubland vegetation cover type occurs in drainages within the proposed Glade Reservoir, U.S. 287 realignment, and Poudre Valley Canal study areas. For the areas mapped remotely, mesic native shrublands may be included in areas mapped as potential wetlands. In dry intermittent and ephemeral drainages and gulches, the mesic native shrubland type is dominated by skunkbush. Chokecherry and wild plum commonly occur with skunkbush in these dry drainages. Sandbar willow-dominated shrublands occur in the moister drainages, and typically have an understory of mostly native species, although noxious weeds, such as Canada thistle, are present.

The mesic native shrubland vegetation cover type is of moderate to high quality. Introduced species and noxious weeds are found in the understory.

3.10.3.3 Mesic Mixed Shrublands

The mesic mixed shrubland vegetation cover type occurs in the Glade Reservoir and U.S. 287 realignment study area. This vegetation cover type contains a mixture of native and introduced species, as well as noxious weeds. Rubber rabbitbrush is the dominant species with an understory of western wheatgrass, smooth brome, intermediate wheatgrass, and meadow fescue. Skunkbush and yucca also are common.

The mesic mixed shrubland vegetation cover type is of moderate quality.

3.10.4 Woodlands

Woodlands are vegetation cover types dominated by evergreen or deciduous trees. Evergreen trees, such as ponderosa pine, occur on drier hillsides, while deciduous trees, such as plains cottonwood, occur in riparian areas along creeks and streams, and around stock and irrigation ponds. Because of their structural diversity, woodlands typically provide good quality wildlife habitat.

3.10.4.1 Upland Native Woodlands

The upland native woodlands vegetation cover type is located on the western edge of the Glade Reservoir study area and in the Glade to Horsetooth pipeline study area. Upland native woodlands are dominated by ponderosa pine and/or Rocky Mountain juniper, with native grasses such as blue grama and western wheatgrass in the understory.

The upland native woodland vegetation cover type is of moderate to high quality, although some introduced species such as cheatgrass are present in the understory.

3.10.4.2 Mesic Mixed Woodlands

Mesic mixed woodlands occur along the larger tributaries and rivers in the Glade Reservoir, U.S. 287 realignment, the pipeline study areas, and No Action study areas. For areas mapped remotely, small areas of mesic mixed woodlands may be included in areas mapped as potential wetlands. Plains cottonwood and peachleaf willow form the overstory of the mesic mixed woodlands. Depending on the site, shrub species such as chokecherry, American plum, Wood's rose, and/or sandbar willow may occur. The noxious weed tree, Russian olive, also is common. The understory often includes smooth brome. The mesic mixed woodlands vegetation cover type is of moderate to

high quality, although several introduced species are present in the understory.

3.10.5 Miscellaneous Cover Types

Miscellaneous cover types include agricultural lands, revegetated areas, disturbed areas, landscaped areas, and roads. All of the miscellaneous cover types are of low quality because of past or ongoing disturbance, the prevalence of bare soil, buildings or paved surfaces, prevalence of introduced species, and limited wildlife habitat.

3.10.5.1 Agricultural Lands

Agricultural areas that have been cultivated, irrigated, or otherwise managed for agricultural purposes are common at the Cactus Hill Reservoir study area, in all of the pipeline study areas, in the Agricultural Transfer Lands study area, in the Cache la Poudre and South Platte River study areas, and in the No Action study areas. Agricultural lands also are found in the Glade Reservoir study area. Agricultural lands support alfalfa, corn, small grains, hay, and other crops. Also included in the agricultural lands vegetation cover type is fallow ground and disturbed areas associated with agriculture.

3.10.5.2 Revegetated Areas

Revegetated areas occur in the Holcim Mine portion of the U.S. 287 realignment study area and the No Action study areas. Some disturbed areas have revegetated naturally, others have been recently planted or seeded. Weeds such as Kochia, cheatgrass, and leafy spurge are common on spoil piles that were deposited during mining. Native species include snakeweed, rubber rabbitbrush, and Indian ricegrass.

3.10.5.3 Disturbed Areas

Disturbed areas occur throughout all of the study areas. These areas typically support little vegetation and have been intensively disturbed and altered for uses such as corrals, buildings, driveways, canals, roads, and informal vehicle paths. Where vegetation occurs in disturbed areas, it typically is composed of annual and/or noxious weeds.

3.10.5.4 Landscaped Areas

The landscaped areas vegetation cover type is found in urban areas within the proposed Glade to Horsetooth pipeline, the Cactus Hill to Horsetooth pipeline, the Poudre Valley Canal, the Cache la Poudre and South Platte River study areas, and the No Action study area. Included in this vegetation cover type are portions of the cities of Fort Collins and Loveland, and smaller residential areas. Lawns, ornamentals trees, and landscaped facilities (such as parks and golf courses) are included in the landscaped areas cover type.

3.10.5.5 Roads

This cover type includes major roads within the study areas (such as highways, paved roads, and unpaved county roads). Minor roads (such as farm and ditch access roads), were mapped as disturbed areas, or were included in surrounding vegetation cover types.

3.11 NOXIOUS WEEDS

Noxious weeds are introduced, invasive species that are monitored because of their tendency to degrade an area. Noxious weeds are regulated by the State of Colorado.

3.11.1 Regulatory Framework

Several regulations and guidelines pertain to noxious weeds, including Federal Executive Order 13112 Invasive Species Federal Highway Administration Guidance on Invasive Species (August 10, 1999), State of Colorado Executive Order (D 06 99 – Development and Implementation of Noxious Weed Management Programs), CDOT NEPA Project – Noxious Weed Process – Final (CDOT 2004), and the Colorado Noxious Weed Act (Colorado Revised Statutes [C.R.S.] 35-5.5).

The Colorado Noxious Weed Act states that all landowners must manage noxious weeds that may be damaging to adjacent landowners. Rules pertaining to administration of the Act include three lists of noxious weed species (Colorado Department of Agriculture 2004). The State A List contains noxious weed species targeted for eradication within Colorado. If individuals or populations of State A List species are found, the local governing body must provide the State Weed Coordinator with mapping that includes information on location and density of the infestation. The State B List contains species that the state has targeted for control rather than eradication. The State C List contains species for which the state will provide support and funding for local control efforts.

3.11.2 Noxious Weeds in the Study Areas

Noxious weeds occur in all of the study areas. The following noxious weeds were commonly observed during field surveys: field bindweed (C List), leafy spurge (B List), Russian olive (B List), Canada thistle (B List), Dalmatian toadflax (B List), quackgrass (B List), common mullein (C List), musk thistle (B list), and tamarisk (B List). Weed concentrations generally occur in areas that have

been disturbed in the past, and are more common in the mixed or introduced vegetation cover types (such as upland introduced grasslands, upland mixed grasslands, mesic mixed shrublands, and disturbed land types).

3.12 WETLANDS AND OTHER WATERS

Wetlands are areas that occur on the gradient between upland areas and aquatic areas. Wetlands play an important role in the ecosystem. The following discussion provides a summary of those wetlands and other waters which may be affected by NISP, either by construction of reservoirs, forebays, or other associated facilities, or through changes to streamflows. More detailed information is provided in the Wetlands and Other Waters Technical Report (ERO 2008b).

3.12.1 Regulatory Framework

Activities for all of the alternatives (including the No Action alternative) would involve the discharge of dredge or fill material into wetlands or other waters of the U.S. to construct facilities. The Corps regulates the placement of dredge or fill material into waters of the U.S. under Section 404 of the Clean Water Act. Federal agencies also have responsibilities to avoid, minimize, and mitigate unavoidable impacts on wetlands under EO 11990. The Corps defines wetlands (33 CFR Part 323.2[c]) as—

...those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Other waters of the U.S. include streams (perennial, intermittent, and ephemeral), ponds, and lakes (33 CFR Part 328.3[a]). Waters tributary to navigable and interstate waters are considered waters of the U.S. and are subject to the Corps' jurisdiction. Wetlands subject to the Corps' jurisdiction (jurisdictional wetlands) meet the Corps' definition of wetlands and are adjacent, neighboring, or have a surface tributary connection to interstate or navigable waters of the U.S. For purposes of this EIS, the determination of the jurisdictional status of wetlands has not been made. During a preliminary review, the Corps determined that all of the project alternatives would have activities that would involve the discharge of dredge or fill material into jurisdictional wetlands and/or waters of the U.S., and that although some wetlands and other waters in the study area may not fall under the Corps' jurisdiction under Section 404, they still are aquatic resources that will be addressed by the Corps under Section 404 and NEPA. Effects to jurisdictional wetlands and waters will be determined as part of the Section 404 permit application process between the draft and final EIS.

3.12.1.1 Wetlands

Wetlands and other waters were mapped in all of the study areas. In the Glade, Galeton, and Cactus Hill study areas and the U.S. 287 realignment study area, mapping included onsite mapping and data collection. In the Glade to Horsetooth, Cactus Hill to Horsetooth, and Carter pipeline study areas, and other areas without access, wetlands were mapped remotely and reviewed from public roads where possible.

Wetlands were classified according to Cowardin et al. (1979). Types of wetlands that occur in the study areas include: palustrine persistent emergent wetlands dominated by grasses, sedges, and rushes;

and palustrine scrub-shrub wetlands dominated by shrub species such as willows. Some wetlands contain more than one type of wetland; in those cases, the dominant wetland type was used. Some wetlands may include scattered deciduous trees such as cottonwood and willow. Detailed information about wetlands and other waters can be found in the Wetlands and Other Waters Resources Technical Report (ERO 2008b). The acreage of wetlands in the three reservoir study areas are shown in (Table 3-17, Table 3-18, and Table 3-19).

3.12.1.1.1 Palustrine Persistent Emergent Wetlands

Palustrine persistent emergent wetlands are the most common wetland type in the NISP study areas. Most wetlands in the study area are palustrine persistent emergent, and occur in moist meadows, along creeks and streams, around ponds, and in drainage swales. Wetlands in the Poudre Valley Canal study area mainly occur as a fringe along the canal. Palustrine persistent emergent wetlands are dominated by species such as threesquare, rabbit foot, foxtail barley, Nebraska sedge and other sedges, meadow foxtail, redtop, and Baltic rush. Patches of palustrine scrub-shrub wetlands or scattered trees also may occur in palustrine persistent emergent wetlands.

3.12.1.1.2 Palustrine Scrub-shrub Wetlands

Palustrine scrub-shrub wetlands occur in all of the pipeline study areas. Palustrine scrub-shrub wetlands are dominated by sandbar willow and contain many of the same herbaceous species as the palustrine persistent emergent wetlands. Palustrine scrub-shrub wetlands may contain areas of palustrine persistent emergent wetlands, and may also contain scattered trees.

Table 3-17. Wetlands and Other Waters, Glade Reservoir Study Area.

Wetlands^{1,2}	Cowardin Type	HGM Type³	Area (Acres)
Wetland 1	Palustrine persistent emergent	Depressional	0.1
Wetland 2	Palustrine persistent emergent	Depressional	<0.1
Wetland 3	Palustrine persistent emergent	Riverine	0.7
Wetland 4	Palustrine persistent emergent	Depressional	9.0
Wetland 5	Palustrine persistent emergent	Depressional	26.4
Wetland 6	Palustrine persistent emergent	Depressional	1.1
Wetland 7	Palustrine persistent emergent	Riverine	8.0
Wetland 8	Palustrine persistent emergent	Depressional	<0.1
Total Wetlands			45.3
Other Waters			Area (Acres)
Stock and irrigation ponds			0.6
Creeks, streams, ditches, and canals			6.0
Total Other Waters			6.9

¹A determination has not been made regarding the jurisdictional status of these wetlands and other waters under Section 404 of the Clean Water Act.

²This table includes Glade Reservoir and the forebay, but does not include associated pipelines, diversions, or access roads.

³Hydrogeographic Method.

Table 3-18. Wetlands and Other Waters, Galetton Reservoir Study Area.

Wetlands ^{1,2}	Cowardin Type	HGM Type	Area (Acres)
Wetland 1	Palustrine persistent emergent	Depressional	<0.1
Wetland 2	Palustrine persistent emergent	Depressional	<0.1
Wetland 3	Palustrine persistent emergent	Depressional	<0.1
Wetland 4	Palustrine persistent emergent	Depressional	<0.1
Wetland 5	Palustrine persistent emergent	Depressional	<0.1
Wetland 6	Palustrine persistent emergent	Depressional	<0.1
Wetland 7	Palustrine persistent emergent	Depressional	0.2
Wetland 8	Palustrine persistent emergent	Depressional	<0.1
Wetland 9	Palustrine persistent emergent	Depressional	0.1
Wetland 10	Palustrine persistent emergent	Depressional	
Total Wetlands			0.3
Other Waters			Area (Acres)
Stock and irrigation ponds			<0.1
Creeks, streams, ditches, and canals			<0.1
Total Other Waters			<0.1

¹A determination has not been made regarding the jurisdictional status of these wetlands and other waters under Section 404 of the Clean Water Act.

²This table includes Galetton Reservoir, but does not include associated pipelines, diversions, or access roads.

Table 3-19. Wetlands and Other Waters, Cactus Hill Reservoir Study Area.

Wetlands ^{1,2}	Cowardin Type	HGM Type	Area (Acres)
Wetland 1	Palustrine persistent emergent	Depressional	14.5
Wetland 2	Palustrine persistent emergent	Depressional	16.1
Wetland 3	Palustrine persistent emergent	Depressional	14.5
Total Wetlands			45.1
Other Waters			Area (Acres)
Stock and irrigation ponds			5.1
Creeks, streams, ditches, and canals			2.2
Total Other Waters			7.3

¹A determination has not been made regarding the jurisdictional status of these wetlands and other waters under Section 404 of the Clean Water Act.

²This table includes Cactus Hill Reservoir, but does not include associated pipelines, diversions, or access roads.

3.12.1.1.3 *Wetland Functions and Values*

Wetland functional assessments were conducted for the three reservoir study areas and for the U.S. 287 realignment study area using the Montana Method for functional assessments (ERO 2008b). Functional assessments were performed on representative wetland types. For purposes of summarizing wetland functions and values of the wetlands in the study areas, wetlands were grouped into riverine palustrine persistent emergent (those wetlands that occur along drainages), and depressional palustrine persistent emergent (wetlands that occur in depressions).

Some of the Riverine palustrine persistent emergent wetlands were rated high for the following functions:

- general wildlife habitat
- sediment/shoreline stabilization
- production export/food chain support
- ground water discharge/recharge
- sediment/nutrient/toxicant removal

Some of the depressional palustrine persistent emergent wetlands were rated high for the following functions:

- general wildlife habitat
- sediment/nutrient/toxicant removal
- sediment/shoreline stabilization
- production export/food chain support
- ground water discharge/recharge
- dynamic surface water storage

Recreation/education potential and uniqueness values were rated for the representative wetland types. All wetlands were rated low for recreation/education potential. The low rating relates to private ownership and the location, size, and diversity of the wetlands. Most of the wetlands also were rated low for uniqueness. The low rating

for uniqueness is due to the commonness of the wetland types in the region, the potential to replace the wetland, disturbance, and low vegetation diversity.

3.12.1.1.4 *Qualitative Summary of Wetland Functions and Values*

In general, wetlands that occur along perennial streams, around lakes, or that have a variety of cover types and heights such as trees, shrubs, and herbaceous vegetation, or that occur in riparian areas that have a diversity of vegetation cover types, provide higher quality wildlife habitat. Also, wetlands that occur naturally (i.e., not those that have formed as a result of irrigation practices) likely have more native vegetation species than those that did not form naturally or those that have been disturbed by activities such as grazing. Wetlands that intercept herbicides and fertilizers provide valuable treatment of these substances before they enter streams of other water bodies.

In the Glade Reservoir study area, most wetlands are herbaceous wetlands associated with upland meadows or irrigated hay meadows. Some wetlands occur along intermittent streams. There are no perennial streams in the Glade Reservoir study area. In the Galeton Reservoir study area, all of the wetlands are herbaceous, small, and isolated from other waters. In the Cactus Hill Reservoir study area, most of the wetlands are herbaceous and occur in agricultural areas where they intercept agricultural runoff.

In the pipeline study areas and the Poudre Valley Canal study area, wetland functions and values were not quantitatively assessed because wetlands were mapped remotely and ground-truthed. In these study areas, wetland functions and values were assessed qualitatively and assignment of values are general in nature.

The wetlands along the South Platte and Cache la Poudre rivers are of the highest quality in the study area because they are associated with perennial flows and occur in a riparian corridor.

Wetlands along creeks tributary to the South Platte River are typically of moderate quality because they may provide a corridor for wildlife and are associated with areas of open water. However, many of these areas have been disturbed in the past by agricultural activities.

Wetlands in tailwater areas and other depressions in agricultural areas usually are of low quality because they occur in disturbed areas, are typically composed of aggressive species, and are not unique. Tailwater wetlands, however, can process nutrients and chemicals from agricultural fields.

Wetlands associated with stock ponds generally are of low quality because they often are isolated from other waters and are typically trampled by livestock. The quality of wetlands associated with irrigation ponds may vary. In instances where large areas of wetlands, especially combined with trees and shrubs, have formed around irrigation ponds, the quality of the wetlands may range from moderate to high.

Wetlands along the Poudre Valley Canal and other canals are of low quality because they are periodically disturbed or removed as part of ditch maintenance.

3.12.1.2 Other Waters

Other waters in the NISP study area include the Cache la Poudre, South Platte, and Big Thompson rivers, Boulder Creek and St. Vrain Creek, other perennial, intermittent, and ephemeral creeks, stock ponds, irrigation ponds, reservoirs, lakes, ditches and canals. (See Sections 3.3 and 3.4 for additional information.)

3.12.1.3 Agricultural Transfer Lands Study Area

For purposes of this EIS, wetlands in the Agricultural Transfer Lands study area were assessed using the CDOW riparian mapping for Larimer and Weld counties (CDOW 2006) and National Wetland Inventory (NWI) mapping (Service 2006a) (Table 3-20). The CDOW riparian mapping contains riparian vegetation types that, based on the description of the vegetation type and the topographic position, are potential palustrine persistent emergent and palustrine scrub-shrub wetlands. CDOW mapping also was used to map potential wetlands in nearby reference areas that had not been flood irrigated. The reference areas contain palustrine persistent emergent wetlands located along Coalbank, Black Hollow, and Spring Creeks (ERO 2008b).

3.12.1.4 No Action Study Areas

3.12.1.4.1 Wetlands

Wetlands in the No Action study areas likely occur in fringes along gravel lakes proposed for water supply storage, in and around depressions that form temporarily during gravel mining, along the South Platte River, the Cache la Poudre River, St. Vrain Creek, Boulder Creek, and the Big Thompson River. Wetlands were not mapped because there are a number of possible gravel pit storage locations, as discussed in the Water Resources Technical Report (HDR 2007b); however, the impacts to wetland resources will be estimated for the No Action alternative.

In addition, it is likely that wetlands occur in agricultural lands from which irrigation water would be transferred under the No Action alternative. It is estimated that about 1,384 acres of wetlands may occur in the agricultural transfer lands (ERO 2008b).

Table 3-20. Crop Types and Wetlands, Agricultural Transfer Lands Study Area.

Crop Types and Wetlands	Area in Study Area (Acres)
Larimer and Weld Canal	
Alfalfa	4,159
Corn	3,750
Dry beans	195
Fallow	337
Grass/pasture	964
Small grain	991
Sugar beets	230
Vegetables	49
Wetlands and other waters ¹	255
New Cache Canal	
Alfalfa	1,843
Corn	2,468
Dry beans	408
Fallow	116
Grass/pasture	188
Small grain	668
Sugar beets	235
Vegetables	150
Wetlands and other waters ¹	129

¹These wetlands were mapped remotely using riparian mapping from the CDOW and NWI mapping. The CDOW riparian mapping includes vegetation types considered probable wetlands, although this information was not field verified. Hydrogeographic Method (HGM) types were not available for CDOW riparian mapping.

3.12.1.4.2 Other Waters

Waters in the No Action study areas include the South Platte River, Cache la Poudre River, St. Vrain Creek, Boulder Creek, and Big Thompson River. Areas of open water also may have formed in some gravel pits. Waters were not mapped because there are a number of possible gravel pit locations where storage could take place (HDR 2007b).

3.13 RIPARIAN RESOURCES

Several public comments received during the NISP EIS scoping process expressed interest in riparian resources. Therefore, riparian resources are addressed as a specific resource in the NISP EIS.

3.13.1 Regulatory Framework

Colorado Senate Bill 40 (SB 40) requires any agency of the State of Colorado to obtain wildlife certification from the CDOW when the agency plans construction in a stream or its bank or tributaries. Along with impacts to fisheries, wildlife, threatened or endangered species, and other impacts to streams, SB 40 regulates permanent fills of greater than 0.25 acre of wetlands and 0.5 acre of riparian areas at a single location, and temporary fills of greater than 0.5 acre of wetlands and 1 acre of riparian areas at a single location (CDOW 2006). The realignment of U.S. 287 by CDOT may involve filling wetlands or riparian areas.

3.13.2 Riparian Areas

Riparian areas are found bordering intermittent and perennial streams as well as lakes, ponds, and reservoirs, and are intermediate between the aquatic and terrestrial environment. Riparian vegetation types in the NISP study areas include mesic mixed woodlands, mesic mixed shrublands, and mesic native shrublands. Additionally, where wetlands occur along creeks and streams and other water bodies, riparian vegetation types may include palustrine persistent emergent wetlands and palustrine scrub-shrub wetlands. These vegetation types were described previously in the Vegetation Resources and Wetlands and Other Waters sections and are described in the Vegetation Technical Report (ERO 2008a).

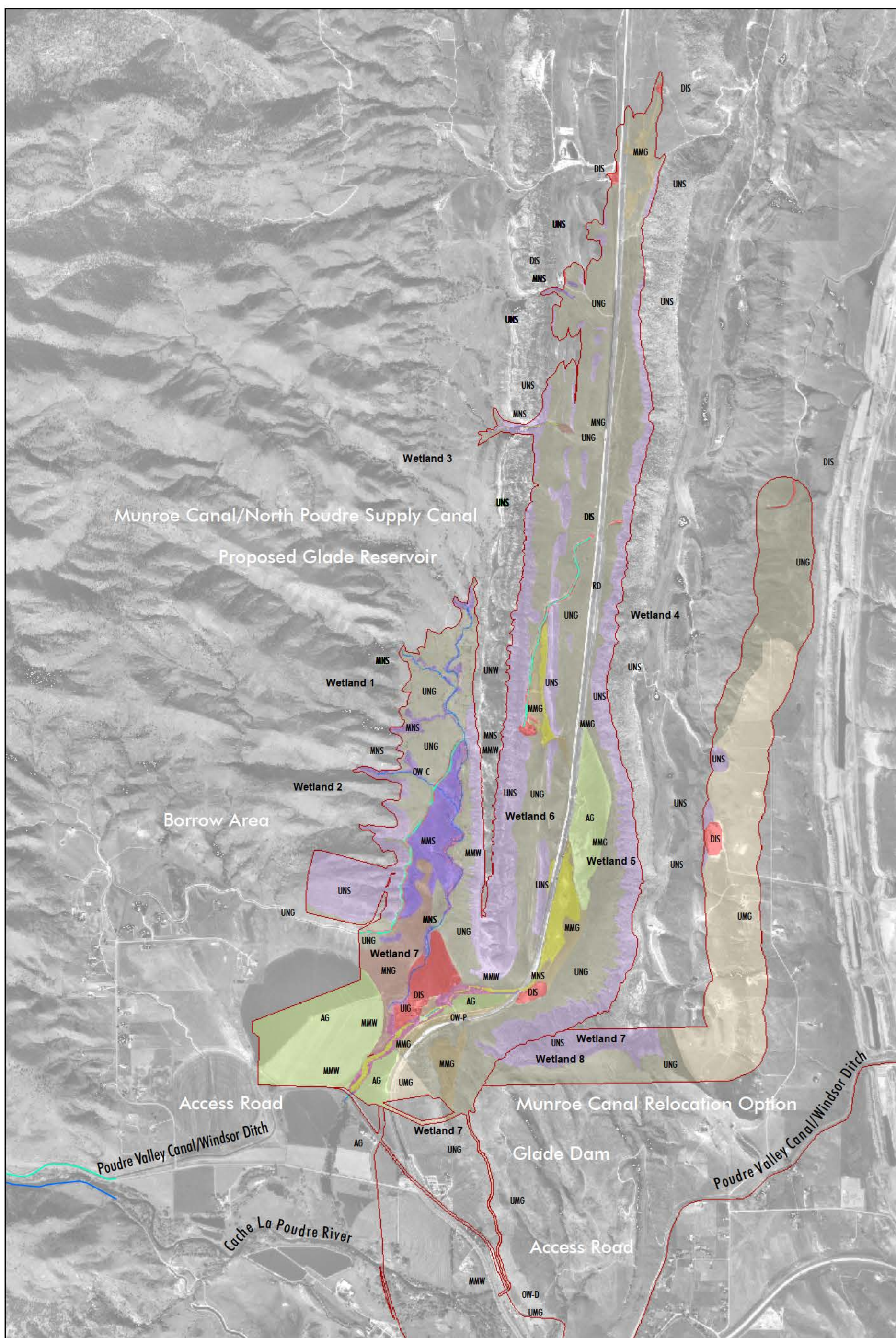
Figure 3-10 through Figure 3-13 show the distribution of all vegetation types including riparian cover types in the Glade Reservoir, Galetton Reservoir, Cactus Hill Reservoir, and U.S. 287 realignment study areas, and at the SPWCP diversion.

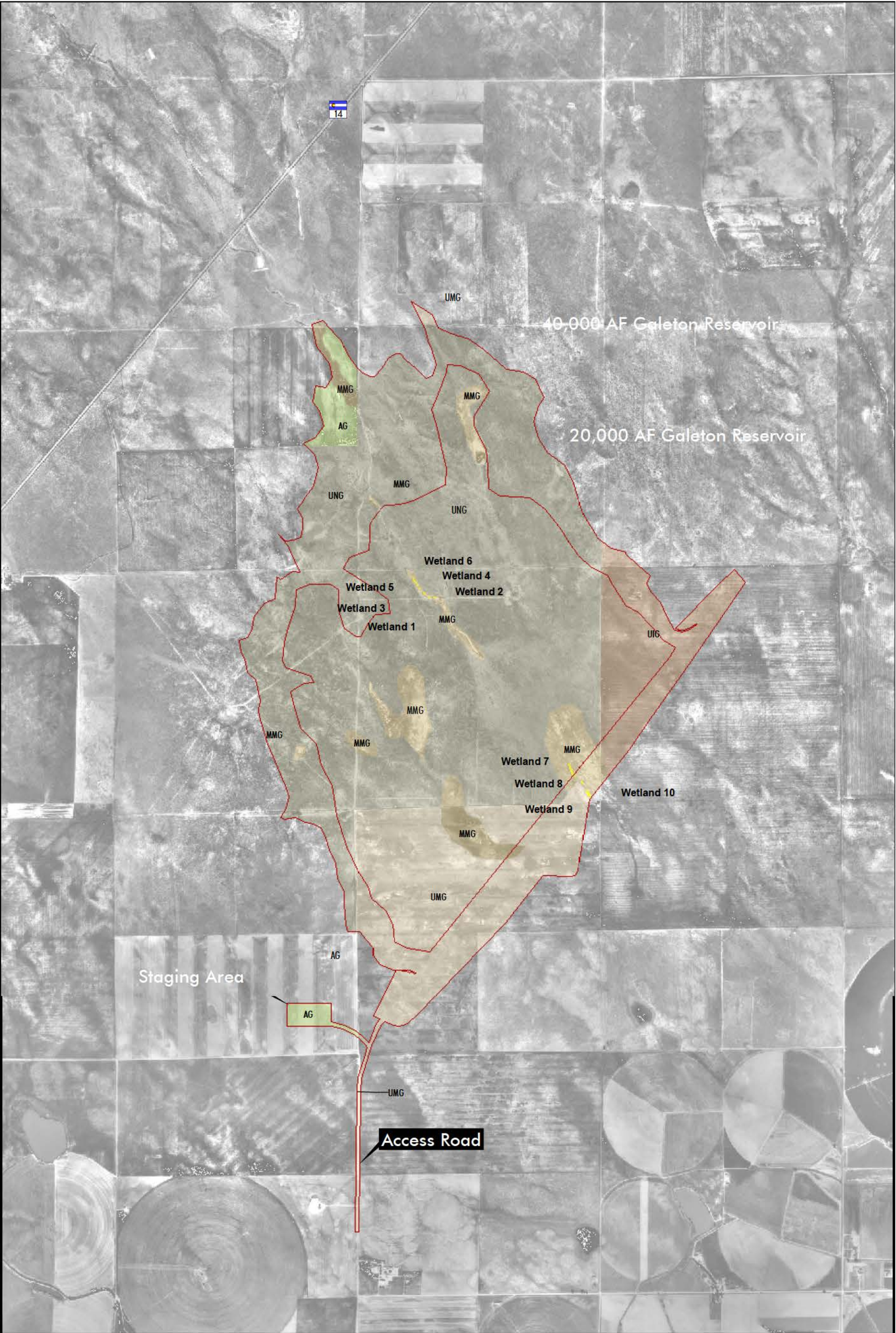
Mesic mixed woodlands occur along Owl Creek at Glade Reservoir, the South Platte River in the SPWCP study area (at the proposed South Platte River diversion), in the Glade to Horsetooth pipeline study area (at the Cache la Poudre River crossing), and in the Cactus Hill to Horsetooth pipeline study area along the abandoned Larimer County Canal No. 2. These mesic mixed woodlands are dominated by cottonwoods, and other trees and shrubs. Mesic mixed shrublands and mesic native shrublands occur along creeks in the Glade Reservoir, Poudre Valley Canal, Cactus Hill to Horsetooth pipeline, U.S. 287 realignment, and Carter pipeline study areas.


Riparian areas in the Carter pipeline study area include mesic mixed woodlands along the St. Vrain Creek and the Big Thompson River, and mesic mixed and mesic native shrublands along other creeks in the study area. Palustrine scrub-shrub wetlands also occur around ponds and along creeks in the Carter pipeline study area.

Most riparian areas occur in the Cache la Poudre and South Platte River study areas and are composed of mesic mixed woodlands. Areas of mesic mixed and mesic native shrublands also occur. The riparian areas in these study areas also include areas of palustrine scrub-shrub wetlands. Figure 3-14 shows the identified sensitive riparian areas managed by the City of Fort Collins along the Poudre River. These natural areas often contain riparian vegetation.

Mesic mixed woodlands are likely to occur in the No Action study areas because many of the potential gravel storage lakes are located in riparian corridors along the South Platte, Cache la Poudre, and Big Thompson River, as well as Boulder and St. Vrain Creeks. The riparian areas in these study areas also likely include mesic mixed and mesic native shrublands as well as palustrine scrub-shrub wetlands. The value of these vegetation types generally is high because of vegetation structural diversity, and because tree and shrub vegetation types provide cover for wildlife.








Environmental Impact Statement

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Study Area

- Grasslands
 - UNG - Upland Native Grasslands
 - UMG - Upland Mixed Grasslands
 - UIG - Upland Introduced Grasslands
 - MMG - Mesic Native Grasslands
 - MMG - Mesic Mixed Grasslands
- Shrublands
 - UNS - Upland Native Shrublands
 - MNS - Mesic Native Shrublands
 - MMS - Mesic Mixed Shrublands
- Woodlands
 - UNW - Upland Native Woodlands
 - MMW - Mesic Mixed Woodlands

Other

- AG - Agricultural Lands
- REV - Revegetated Areas
- DIS - Disturbed
- LS - Landscaped
- RD - Roads
- Wetlands & Other Waters
 - PEW - Palustrine Persistent Emergent Wetland
 - PSSW - Palustrine Scrub-Shrub Wetland
 - OW-P - Other Waters - Ponds, Lakes and Reservoirs
 - OW-C - Other Waters - Creeks and Streams
 - OW-D - Other Waters - Ditches and Canals

0 1,000 2,000 Feet

1 inch = 2,000 Feet

N


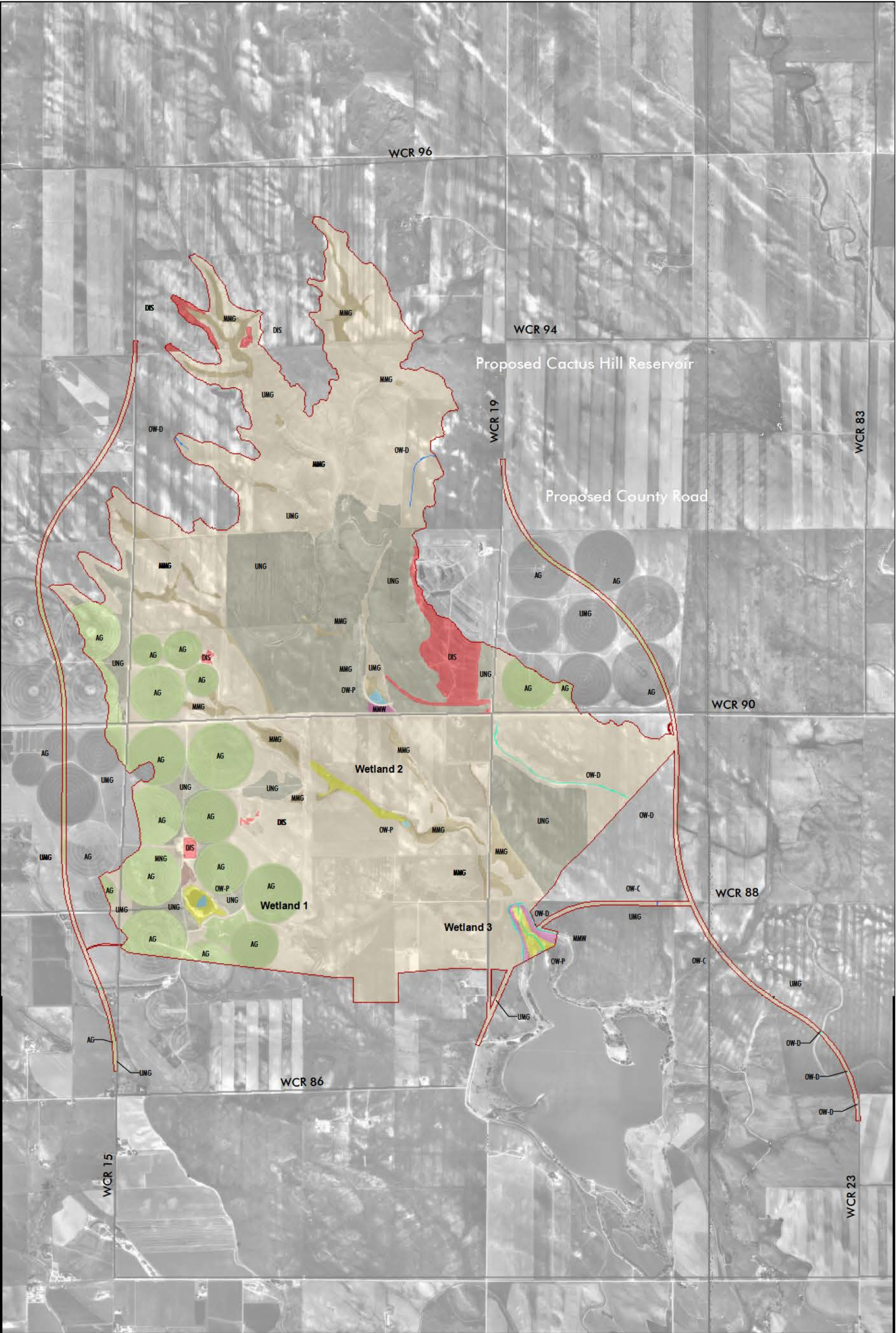



Figure 3-11
Galeton Reservoir
Study Area
Vegetation Cover Types

Prepared for: U.S. Army Corps of Engineers
File: 2701 Galeton_Veg_covertypes.mxd (JP)
January 3, 2008





Environmental Impact Statement

Prepared by:
ERQ

Study Area

Grasslands

- UNG - Upland Native Grasslands
- UMG - Upland Mixed Grasslands
- UIG - Upland Introduced Grasslands
- MMG - Mesic Native Grasslands
- MMG - Mesic Mixed Grasslands

Shrublands

- UNS - Upland Native Shrublands
- MNS - Mesic Native Shrublands
- MMS - Mesic Mixed Shrublands

Woodlands

- UNW - Upland Native Woodlands
- MMW - Mesic Mixed Woodlands

Other

- AG - Agricultural Lands
- REV - Revegetated Areas
- DIS - Disturbed
- LS - Landscaped
- RD - Roads

Wetlands & Other Waters

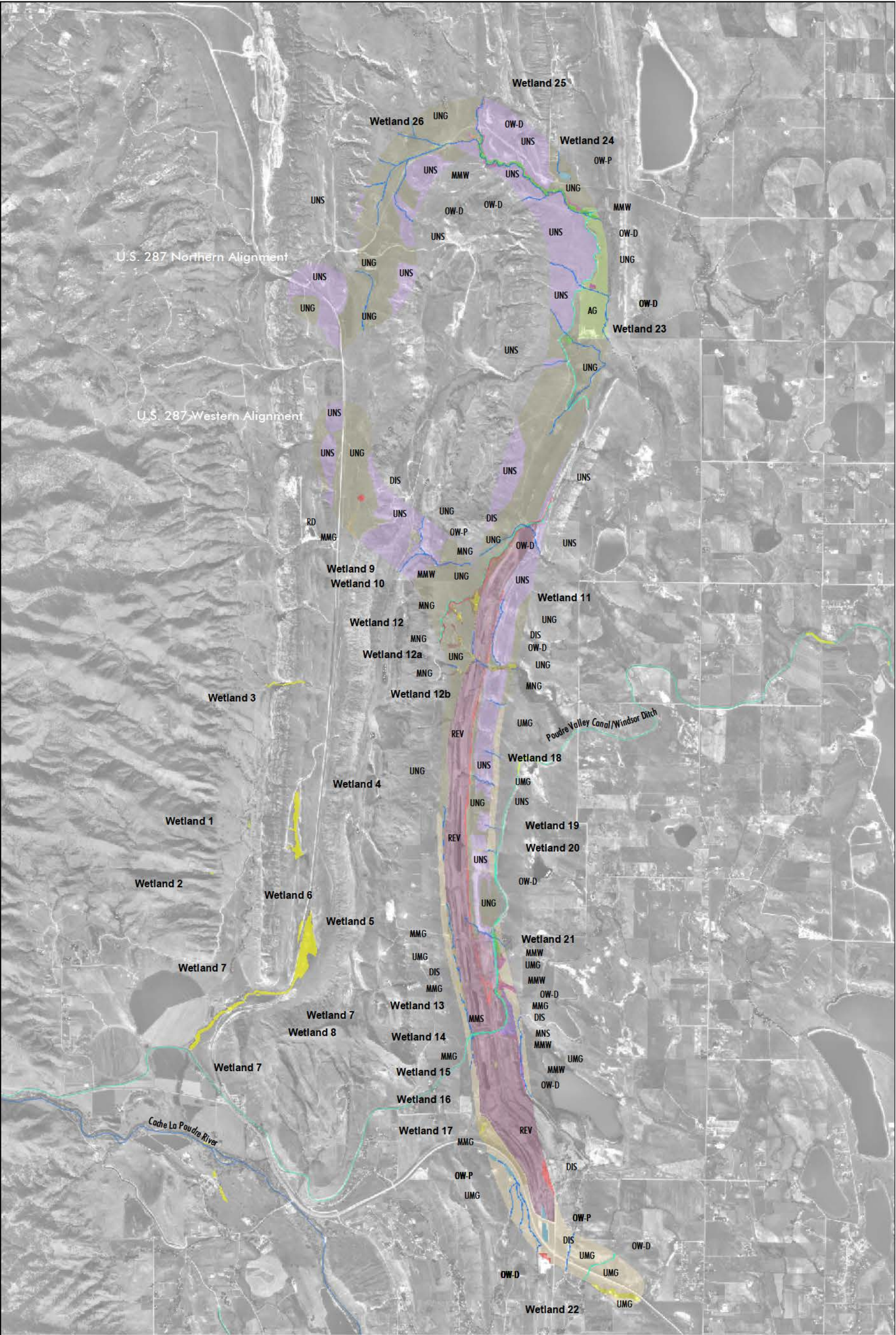
- PEW - Palustrine Persistent Emergent Wetland
- PSSW - Palustrine Scrub-Shrub Wetland
- OW-P - Other Waters - Ponds, Lakes and Reservoirs
- OW-C - Other Waters - Creeks and Streams
- OW-D - Other Waters - Ditches and Canals


0 1,300 2,600 Feet

1 Inch = 2,600 Feet

Figure 3-12
Cactus Hill Reservoir
Study Area
Vegetation Cover Types


Prepared for: U.S. Army Corps of Engineers
File: 2701 CH_veg_covertypes.mxd(IP)
October 17, 2007





Environmental Impact Statement

Prepared by:



Study Area

- Footprint of U.S. 287 Realignments
- UNG - Upland Native Grasslands
- UMG - Upland Mixed Grasslands
- UIG - Upland Introduced Grasslands
- MNG - Mesic Native Grasslands
- MMG - Mesic Mixed Grasslands

Shrublands

- UNS - Upland Native Shrublands
- MNS - Mesic Native Shrublands
- MMS - Mesic Mixed Shrublands

Woodlands

- UNW - Upland Native Woodlands
- MMW - Mesic Mixed Woodlands

Other

- AG - Agricultural Lands
- REV - Revegetated Areas
- DIS - Disturbed
- LS - Landscaped
- RD - Roads

Wetlands & Other Waters

- PEW - Palustrine Persistent Emergent Wetland
- PSSW - Palustrine Scrub-Shrub Wetland
- OW-P - Other Waters - Ponds, Lakes and Reservoirs
- OW-C - Other Waters - Creeks and Streams
- OW-D - Other Waters - Ditches and Canals

0 2,400 4,800 Feet

1 inch = 4,800 Feet

Figure 3-13

U.S. 287 Realignment

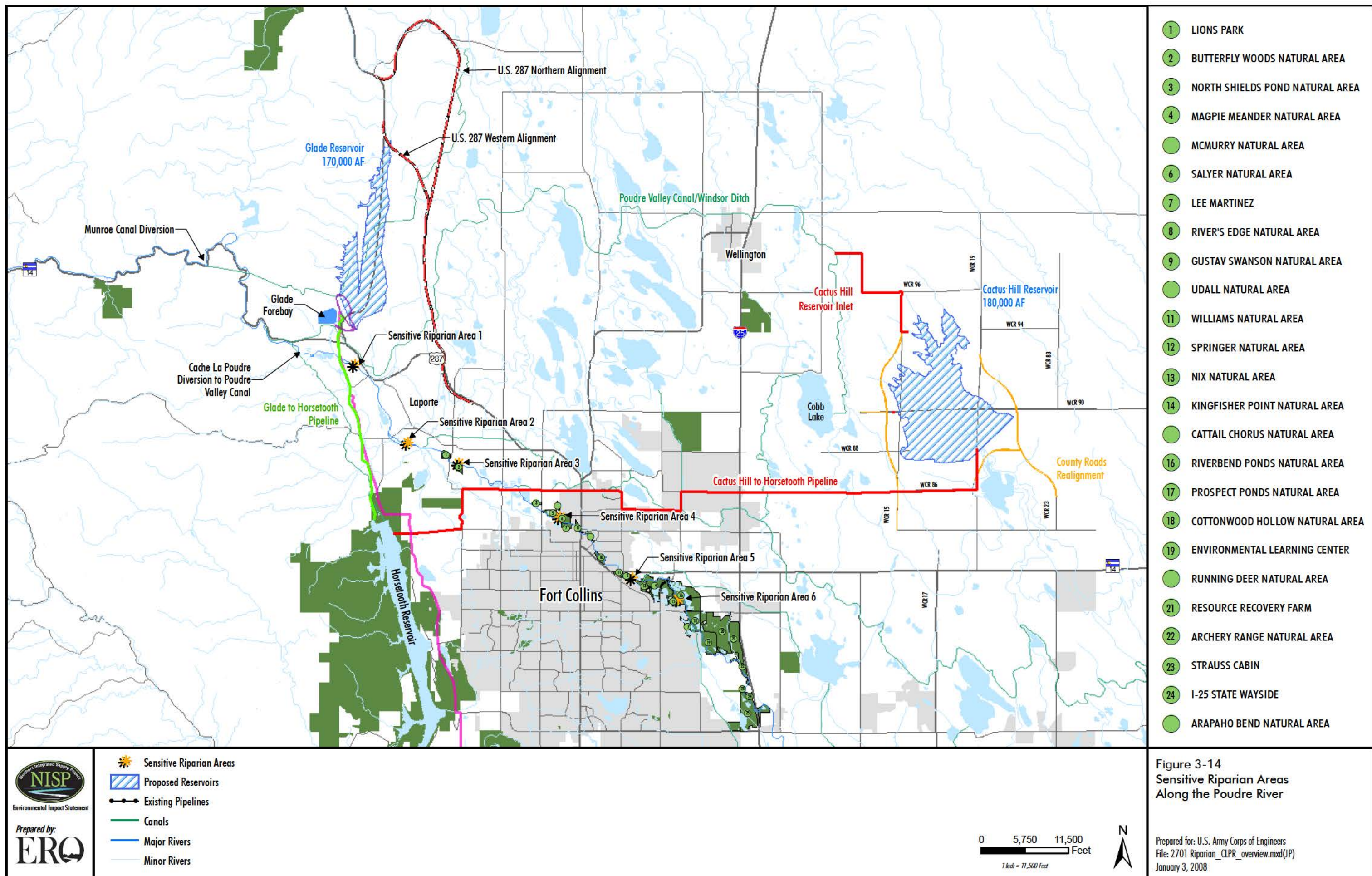
Study Area

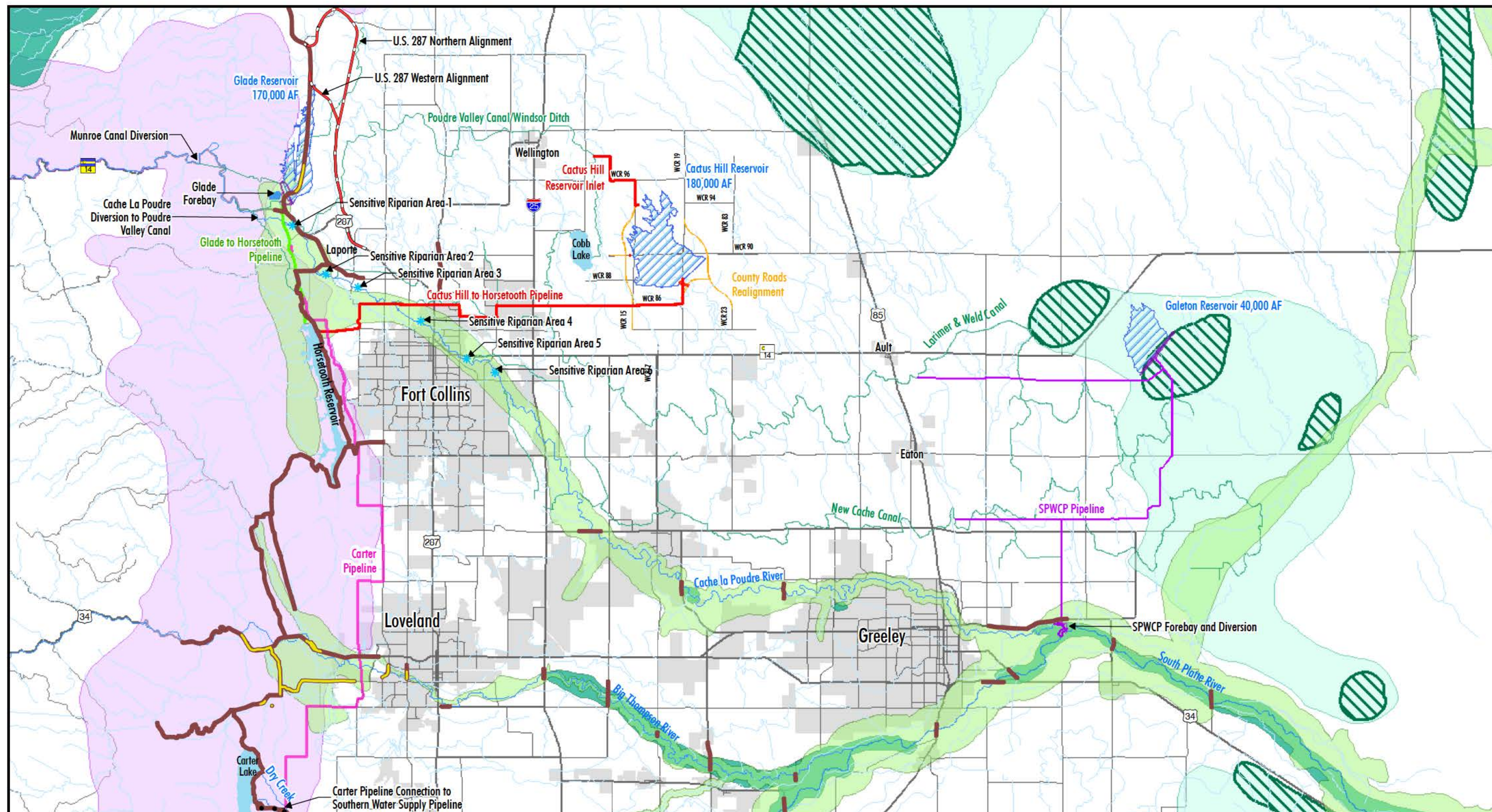
Vegetation Cover Types

Prepared for: U.S. Army Corps of Engineers

File: 2701-Glade_Veg_covetypes.mxd (JP)

January 3, 2008





Prepared by:
ERO

Northern Integrated Supply Project Wildlife Resources

- | | | |
|---------------------|--------------------------------------|-------------------------------|
| Proposed Reservoirs | Pronghorn Winter Concentration Area | Deer Highway Crossing |
| Existing Pipelines | Pronghorn Severe Winter Range | Elk and Deer Highway Crossing |
| Canals | White-tailed Deer Concentration Area | |
| Major Rivers | Mule Deer Winter Concentration Area | |
| Minor Rivers | Mule Deer Severe Winter Range | |

Sources:
CNDIS (2005). Prairie dog habitat for reservoir sites modified per field verification.

0 10,000 20,000 Feet
1 inch = 20,000 Feet



Figure 3-15
Wildlife Habitat in the Study Areas

Prepared for: U.S. Army Corps of Engineers
File: 2701 wildlife_overview_Fig6.mxd(JP)
April 9, 2008

3.14 WILDLIFE

The following section presents a general description of wildlife and their habitats in the study areas, with an emphasis on more commonly occurring species. Wildlife resources discussed include migratory birds and raptors, big game, reptiles and amphibians, and other wildlife species. A detailed description of species expected to occur in the project areas, including their scientific names, is provided in the Wildlife Technical Report (ERO 2008c). Federally listed threatened and endangered species, Colorado state species of concern, and rare and imperiled species tracked by the Colorado Natural Heritage Program (CNHP) are referred to in this document as species of concern and are addressed in Section 3.16.

3.14.1 Regulatory Framework

The Corps is required to consider the effects of their decisions on wildlife resources (33 CFR Part 320.4). As directed by Colorado State Statutes (Colo. Rev. Stat. Ann. §§ 33-1-101-124), the Colorado Wildlife Commission issues regulations and develops management programs for wildlife, which are then implemented by CDOW. Take of game species, such as deer, elk, pheasant, quail, and some species of waterfowl, is permitted through a hunting license. Take of nongame species, such as small mammals, birds, and reptiles, is permitted for specific activities such as scientific collecting.

Migratory birds, including raptors, and any active nests, are protected under the Migratory Bird Treaty Act (MBTA). The MBTA prohibits activities by the project sponsors that may harm migratory birds, their young, or their eggs, including the removal of active nests that results in the loss of eggs or young. In Colorado, most nongame birds except for European starling, house sparrow, and rock dove

(pigeon) are protected under the MBTA (§§ 703-712).

The Fish and Wildlife Coordination Act requires the federal action agency to consult with the U.S. Fish and Wildlife Service (Service) and the CDOW on issues related to conservation of wildlife resources for federal projects resulting in modifications to waters or channels of a body of water (16 U.S.C. §§ 661–667c). A Fish and Wildlife Coordination Act report will be completed as part of the Final EIS.

3.14.2 Wildlife Common to All Study Areas

The study areas provide habitat for a variety of wildlife typical of the plains/foothills ecotone and the northeastern plains of Colorado. This section describes wildlife likely to occur in similar habitats found in the study areas. An overview of wildlife in the study areas is shown in Figure 3-15. The linear pipeline and canal study areas traverse predominantly grassland and agricultural habitat types, but also wetland and riparian areas mostly found at drainage crossings. Wildlife and habitat characteristics particular to individual study areas are discussed in separate sections.

3.14.2.1 Raptors and Other Migratory Birds

3.14.2.1.1 Raptors

Riparian areas provide high quality nesting habitat for a variety of raptors, including the American kestrel, red-tailed hawk, Cooper's hawk, and great-horned owl. A bald eagle nest is located along the Poudre River south of the proposed Glade Reservoir, and is discussed in greater detail in the Species of Concern section. Rock ledges of the hogback formations also provide nesting habitat for raptors such as the turkey vulture, red-tailed hawk, and golden eagle. These species, as well as the

Swainson's hawk, ferruginous hawk, and American kestrel, are likely to forage among grassland and agricultural areas where prey species such as the black-tailed jackrabbit, cottontail rabbit, and black-tailed prairie dog are abundant. The northern harrier potentially may occur in these habitats, as well as in wetlands. Isolated groups of mature cottonwoods found in many of the study areas provide important shade, cover, and nesting habitat for raptors.

3.14.2.1.2 Other Migratory Birds

Upland native shrublands in the study areas provide habitat for the spotted towhee, scrub jay, dusky flycatcher, and green-tailed towhee. The cliff swallow is likely to nest along the rocky ridges of the hogbacks. Birds commonly associated with agricultural and grassland habitats in the study areas include ground-nesting species such as the western meadowlark, lark sparrow, vesper sparrow, killdeer, and horned lark. Burrowing owls nest among some prairie dog colonies found in several study areas. Burrowing owls are discussed further in the Species of Concern section.

Wetlands and open water provide potential breeding and foraging habitat for species such as the red-winged blackbird, yellow-headed blackbird, song sparrow, and common snipe. The American coot and various duck species, including the American widgeon, blue-winged teal, and mallard, may nest in cattail stands or along the shorelines of open water. Shorebirds such as spotted sandpiper and American avocet may nest and forage on shorelines as well.

Riparian areas provide nesting and foraging habitat for birds such as the great blue heron, house wren, Bullock's oriole, northern flicker, and tree swallow. Isolated groups of large cottonwoods provide important shade, cover, and nesting habitat for birds. Species likely to nest among trees in grasslands or agricultural habitats in the study areas are the

mourning dove, eastern kingbird, and black-billed magpie.

3.14.2.2 Big Game

Big game species typically found in the plains and prairie/foothills ecotone of northeastern Colorado potentially occur in the study areas. Although generally widespread, overall range for elk, mule deer, white-tailed deer, and pronghorn is progressively being lost or degraded due to development associated with increased growth in the region (ERO 2008c; Vieira et al., pers. comm. 2008).

3.14.2.2.1 American Elk

The American elk primarily inhabits the western two-thirds of the state, but is occasionally found east of the Front Range foothills. Although elk tend to migrate from lower elevations used in winter to higher elevations in spring and summer, some herds are relatively sedentary. Elk are generalist herbivores, feeding on grasses, forbs, and shrubs. Calving areas are usually located in proximity to water where forage and cover are abundant (Fitzgerald et al. 1994). Overall elk range occurs in the westernmost study areas located at the base of the hogbacks.

3.14.2.2.2 Mule Deer

In Colorado, mule deer occupy all ecosystems from grasslands to alpine tundra. Mule deer generally migrate seasonally, spending summer months at higher altitudes and moving to lower elevations during winter. Mule deer primarily are browsers, feeding mostly on shrubs, although forbs and grasses comprise a significant proportion of the mule deer diet, especially in spring and summer. This species reaches its greatest densities in shrublands that provide abundant forage and cover (Fitzgerald et al. 1994). Overall mule deer range extends throughout all the study areas.

Mule deer winter concentration areas occur in the westernmost study areas (Figure 3-15). Mule deer winter range is found in many of the study areas (CNDIS 2005).

3.14.2.2.3 White-tailed Deer

The white-tailed deer is less widespread and more secretive than the mule deer. White-tailed deer are often seen in riparian areas bordering larger streams and rivers. Although this species does not migrate in large numbers like elk, white-tailed deer will move seasonally up and down river corridors in small numbers (Fitzgerald et al. 1994). Riparian areas in the study areas provide habitat favored by white-tailed deer.

White-tailed deer concentration areas occur in higher quality riparian habitat (Figure 3-15). The CDOW does not designate winter or summer concentration areas or severe winter range for white-tailed deer.

3.14.2.2.4 Pronghorn

The American pronghorn inhabits grasslands and semi-desert shrublands on rolling topography that provides good visibility (Fitzgerald et al. 1994). Pronghorn tend to favor vast expanses of open areas and are typically sensitive to human presence including residential and commercial development and habitat loss (Sawyer and Lindzey 2000).

Grassland areas found in all the study areas provide habitat for the pronghorn antelope. Pronghorn winter concentration areas and severe winter range are found in the largest areas of grassland habitat in the eastern study areas (Figure 3-15).

3.14.2.2.5 Bighorn Sheep

Thought once to have ranged throughout the Colorado foothills and mountains, bighorn sheep are currently more sporadically distributed in locations throughout the higher mountains. A large sheep concentration area has been identified in the Big

Thompson Canyon, south and west of the Glade Reservoir study area.

3.14.2.3 Amphibians and Reptiles

Amphibians and reptiles known to occur in the plains and prairie/foothills ecotone of northeastern Colorado may be found in all of the study areas.

3.14.2.3.1 Amphibians

Many amphibians inhabit areas near wetlands and areas containing a water source throughout much of the year. A few species that tolerate extended dry periods may be found considerable distances from water (Hammerson 1999). Species potentially occurring in study area wetlands include the northern leopard frog, Woodhouse's toad, tiger salamander, bullfrog, and western chorus frog.

Amphibian species potentially occurring in the drier areas of the study areas are the plains spadefoot, Great Plains toad, and Woodhouse's toad. The Great Plains toad has never been documented in Larimer County, but it occurs throughout Weld County and may occur in the easternmost study areas (Cactus Hill Reservoir, Galetton Reservoir, and SPWCP pipeline study areas).

3.14.2.3.2 Reptiles

Reptiles are not as dependent on water as amphibians, but wetter habitats tend to support a higher diversity of species (Hammerson 1999). Reptiles potentially occurring in wetlands and open water in the study areas include the painted, soft-shelled, and snapping turtles; the northern water snake in areas with aquatic habitats; and plains, western, and common gartersnakes in most terrestrial habitats. Wide-ranging reptile species that potentially occur in each of the study areas include the eastern fence lizard, short-horned lizard, bullsnake, western hognose snake, plains milk snake, western terrestrial gartersnake, and western rattlesnake. The easternmost study areas may

contain habitat for eastern plains reptile species such as the box turtle, many-lined skink, six-lined racerunner, lesser earless lizard, eastern yellow-bellied racer, and plains black-headed snake.

3.14.2.4 Additional Wildlife

The study areas provide habitat for both large and small mammals typically found in undisturbed habitats occurring in the plains/foothills ecotone and the northeastern plains of Colorado, as well as those associated with agricultural areas. Upland native shrub vegetation, rocky ridges, and outcroppings provide potential habitat for two large carnivores—the mountain lion and the black bear. The mountain lion typically inhabits rocky outcroppings and ridges in and near the foothill and mountainous areas of the State. The black bear inhabits montane shrublands and forests, ranging from the edge of the alpine tundra to canyon country and lower foothills (Fitzgerald et al. 1994). A small black bear summer and fall concentration area occurs south and west of the Glade Reservoir study area and north of the Cache la Poudre River (CNDIS 2005). Small mammals commonly found in rocky or montane shrub habitats within the study areas include the bushy tailed wood rat and Mexican wood rat, rock squirrel, and rock mouse. Rock outcroppings also provide potential roosting habitat for the little brown myotis and big brown bat.

Agricultural and grassland habitats are abundant in all the study areas, providing potential habitat for carnivores such as the coyote, red fox, badger, and swift fox. Small mammals commonly occurring in agricultural and grassland habitats include the black-tailed jackrabbit, desert cottontail rabbit, eastern and/or mountain cottontail rabbit, Ord's kangaroo rat, and black-tailed prairie dog. Other small mammals likely to occur in association with grasslands and agricultural areas include the thirteen-lined ground squirrel, spotted ground

squirrel, plains pocket gopher, olive-backed pocket mouse, plains pocket mouse, hispid pocket mouse, deer mouse, and prairie vole.

Wetlands in the study areas provide potential habitat for a variety of mammals such as the raccoon, meadow vole, and western harvest mouse. Study area riparian habitats potentially support the striped skunk, raccoon, meadow vole, western harvest mouse, white-footed mouse, and Preble's meadow jumping mouse (see Species of Concern section). Deciduous trees occurring in riparian areas provide roost sites the hoary bat, little brown myotis, and silver-haired bat.

3.14.3 Glade Reservoir Study Area

Located within a series of north/south oriented ridges (or hogbacks) and valleys at the base of the Rocky Mountain foothills, the Glade Reservoir study area comprises a diversity of habitats, including pine woodlands, native shrubland, grasslands, wetlands, and riparian areas. Topographical features such as sandstone ridges, rocky outcrops, and cliffs add to the study area's habitat diversity, providing shelter and nesting habitat for wildlife.

The riparian and wetland habitat associated with an unnamed tributary to the Cache la Poudre River, the North Poudre Supply Canal, and the Poudre Valley Canal provide high-quality nesting and foraging habitat, as well as hiding and thermal cover, for a variety of species. Several potential raptor nests were observed in these areas. Most of the cliff faces and rock ledges of the hogback formations are unsuitable for larger raptor species such as the red-tailed hawk or golden eagle. However, a few raptor nests were identified on rock ledges overlooking the location of the western arm of the proposed Glade Reservoir.

Although elk may occasionally forage within the Glade Reservoir study area, they are not known to concentrate in significant numbers in this area (CNDIS 2005). The nearest elk resident population occurs primarily west of the proposed Glade Reservoir footprint. Barriers to movement of this elk herd include SH 14, Seaman Reservoir, and the steep canyons of the north fork of the Poudre River. Eastward movement of deer and elk in this area is limited by U.S. 287 and the Holcim Mine. A portion of U.S. 287 within the Glade Reservoir study area is considered an elk highway crossing (Figure 3-15). In addition, regular north-to-south elk and deer movement occurs along the hogbacks to the east of U.S. 287 (Vieira et al., pers. comm. 2008), the precise location and frequency of these movements is unknown.

The extreme western portion of the Glade Reservoir study area includes a mule deer winter concentration area. Mule deer winter range covers the entire Glade Reservoir study area (CNDIS 2005). A mule deer highway crossing area occurs along the entire length of the existing U.S. 287 within the Glade Reservoir study area (Figure 3-15), indicating significant east-west movement of deer in this area. A white-tailed deer concentration area occurs along the Poudre River within the southern portion of the Glade Reservoir study area near the proposed forebay, and a white-tailed deer crossing area occurs along SH 14 and U.S. 287 at the mouth of Poudre Canyon (CNDIS 2005).

The Glade Reservoir study area contains sizeable areas of wetland habitat suitable for breeding amphibians. An adult northern leopard frog and Woodhouse's toad were observed in the Glade Reservoir study area (ERO 2008a).

Several reptile species were observed within the Glade Reservoir study area including the common gartersnake, western hognose snake, plains milk

snake, western rattlesnake, eastern fence lizard, and short-horned lizard (ERO 2008c).

The Glade Reservoir study area contains high quality habitat for the mountain lion. In addition, a small black bear summer and fall concentration area occurs south and west of the Glade Reservoir study area and north of the Cache la Poudre River (CNDIS 2005), and black bears may occasionally forage at the Glade Reservoir study area.

3.14.4 Galeton Reservoir Study Area

Grassland and agricultural land predominate at the Galeton Reservoir study area. Much of the site is heavily grazed by cattle. An approximately 240-acre prairie dog colony is located within the footprint of the proposed Galeton Reservoir. Three recently fledged Swainson's hawks were observed near a nest in a single cottonwood tree just exterior to the southwestern edge of the proposed Galeton Reservoir dam footprint (ERO 2008c).

The expansive grasslands at the Galeton Reservoir study area provide quality habitat for pronghorn, which were observed at the study area (ERO 2008c). Pronghorn winter concentration areas cover the entire Galeton Reservoir study area. Severe winter range occurs in the southeastern portion of the Galeton Reservoir study area (Figure 3-15).

The Great Plains toad occurs throughout Weld County and may occur in the Galeton Reservoir study area. The Galeton Reservoir study area provides potential habitat for carnivores such as the coyote, red fox, and badger. The swift fox, a state species of concern, and the coyote were observed at the Galeton Reservoir study area. Small mammals are abundant at the Galeton Reservoir study area, including the black-tailed jackrabbit, desert cottontail rabbit, eastern and/or mountain cottontail rabbit and Ord's kangaroo rat.

3.14.5 Cactus Hill Reservoir Study Area

The Cactus Hill Reservoir study area is characterized primarily by agricultural land and grassland habitat, interspersed with small wetlands and isolated clusters of mature cottonwoods scattered along drainages of the study area. A small pond occurs in a wetland area in the central portion of the study area. Cottonwoods provide important shade, cover, and nesting habitat for raptors and other wildlife in otherwise exposed areas. During site visits, a great-horned owl and a red-tailed hawk were flushed from a group of three cottonwoods located along an ephemeral drainage in a pasture (ERO 2008c).

Mule deer winter range occurs in the eastern portion of the Cactus Hill Reservoir study area (Figure 3-15). Although pronghorn were observed at the Cactus Hill Reservoir study area, no pronghorn concentration areas or important winter habitat have been designated (CNDIS 2005). Coyotes were observed at the Cactus Hill Reservoir study area, and small mammals, including the black-tailed jackrabbit, cottontail rabbit, and prairie dogs are abundant in pastures and grassland areas.

3.14.6 SPWCP Pipeline Study Area

The riparian areas at the confluence of the Poudre and South Platte rivers in the SPWCP pipelines and diversion study area provide nesting and foraging habitat, as well as hiding and thermal cover for wildlife. Wetlands occurring in the Poudre/South Platte River floodplain also support a wide variety of species. Mule deer severe winter range occurs in the SPWCP study area at the confluence of the Poudre and South Platte rivers, as does a white-tailed deer concentration area (Figure 3-15).

3.14.7 Glade to Horsetooth Pipeline Study Area

The proposed Glade to Horsetooth pipeline route crosses through areas of well-developed wetland and riparian vegetation associated with the Poudre River corridor. A bald eagle nest is located along the Poudre River south of the proposed Glade Reservoir (see Species of Concern section).

The Glade to Horsetooth pipeline study area is located on the eastern edge of elk overall range. Both mule deer and white-tailed deer winter concentration areas occur along portions of the Glade to Horsetooth pipeline study area (Figure 3-15). Riparian areas in the study area provide foraging habitat and thermal and visual protection for deer and elk.

3.14.8 Cactus Hill to Horsetooth Pipeline Study Area

Wildlife species associated with grassland and agricultural habitat are common in the Cactus Hill to Horsetooth pipeline study area. Riparian and wetland habitat in the Cactus Hill to Horsetooth pipeline study area are limited, but occur primarily where the proposed pipeline crosses the Poudre River, and to a lesser extent, along minor drainages and canals. The Cactus Hill to Horsetooth pipeline study area includes a portion of a mule deer winter concentration area, mule deer winter range, and a white-tailed deer winter concentration area along the Poudre River and in the vicinity of Horsetooth Reservoir (Figure 3-15). A small area of mule deer winter range occurs just south of the Cactus Hill Reservoir study area.

3.14.9 Carter Pipeline Study Area

For the northern portion of the Carter pipeline study area, wildlife species likely to occur are similar to those described for the Glade to Horsetooth pipeline study area. The portion of the Carter pipeline study area between Horsetooth and Carter reservoirs consists of mostly agricultural land, except for urban areas within the City of Loveland. Riparian and wetland habitat in this portion of the Carter pipeline study area is generally limited to locations where the proposed pipeline crosses the Big Thompson River, and to a lesser extent, minor drainages and canals. A mule deer winter concentration area occurs along portions of the Carter pipeline study area, and mule deer winter range encompasses the entire Carter pipeline study area (Figure 3-15).

3.14.10 Poudre Valley Canal Study Area

The Poudre Valley Canal study area west of the Holcim Mine is characterized by grasslands, agricultural land, and scattered residential lots. East of the Holcim Mine, the Poudre Valley Canal travels near three reservoirs and crosses several drainages with associated wetlands and riparian woodlands. Wetlands along the canal are disturbed periodically or removed during maintenance and thus have limited value to wildlife. Some higher quality wetlands occur where the canal crosses intermittent and ephemeral drainages.

3.14.11 Poudre-South Platte River Corridor Study Area

Vegetation in the Poudre-South Platte River corridor study area is characterized by wide bands of riparian habitat consisting of mature cottonwood trees. This section of the Poudre River flows through several municipalities, including the cities of Fort Collins

and Greeley; thus, it is heavily impacted by urban activities. Nonurban land adjacent to the river in this study area is heavily grazed. Areas of undisturbed riparian and wetland habitat occur in natural areas, state wildlife areas, and other areas protected from development such as the Environmental Learning Center in Fort Collins and the Poudre Learning Center in Greeley. Wildlife species tolerant of human disturbance associated with riverine and riparian habitat likely occur in this study area. White-tailed deer winter range and concentration areas occur throughout the Poudre-South Platte River corridor study area (Figure 3-15). The Poudre-South Platte River corridor study area provides breeding, wintering, and migratory habitat for a variety of waterfowl species. According to Andrews and Righter (1992), 16 species of ducks are described as common to abundant in the Poudre-South Platte drainage (including the study area) during migration, breeding, and winter. Several other duck species are rare to uncommon, but regularly occur in the drainage.

3.14.12 Agricultural Transfer Lands Study Area

The Agricultural Transfer Lands study area is primarily irrigated agricultural lands used for cultivation of alfalfa, corn, hay, and other crops or as pastureland. Big game such as pronghorn antelope, mule deer, and white-tailed deer, as well as raccoons and skunks, potentially forage in these areas. Waterfowl may stop in fields to rest and feed during winter, spring, and fall migration. Raptors may forage in these areas, which likely support numerous small mammals. Heavily grazed areas may be occupied by prairie dog colonies.

3.14.13 Participant No Action Study Areas

The No Action study areas include open water, wetlands, and riparian habitat associated with gravel lakes, depressions that form temporarily during gravel mining, and portions of the South Platte River, the Cache la Poudre River, St. Vrain Creek, Boulder Creek, and the Big Thompson River corridors. Because the No Action study areas are generally disturbed and/or include urban areas, riverine species adapted to disturbance by human activity are expected to occur in these study areas. White-tailed deer winter range and concentration areas occur throughout the No Action study areas.

3.15 FISH AND OTHER AQUATIC LIFE

This section presents a summary of the existing aquatic biological resources for the Cache la Poudre and South Platte rivers in reaches that would be affected by changes in streamflows associated with the action alternatives. Fish and invertebrates and their habitat in the study area could be affected by changes in streamflows and the creation of new reservoir habitat. More detailed information on aquatic resources is presented in the Aquatic Biological Resources Technical Report (GEI 2008).

The aquatic resources potentially affected by NISP include fish and invertebrate populations and their habitat within the study areas. Any of the alternatives could potentially affect the water bodies and aquatic resources within the study areas through modified flow regimes, changes in reservoir levels, creation of new aquatic habitat, or changes in water quality.

3.15.1 Regulatory Framework

Fish are protected by a variety of laws and regulations including the ESA, Fish and Wildlife Coordination Act, and SB 40. There are no known federally listed fish species in the study areas so ESA does not apply. The CDOW has the authority to manage and conserve wildlife resources within the State of Colorado for hunted, fished, and nongame wildlife. The CDOW enforces various fishing regulations, including regulations concerning the illegal take or use of threatened and endangered species. Colorado State Statute 33-2-102 states that endangered or threatened species should be protected for the purpose of maintaining and enhancing their numbers to the extent possible. Additionally, SB 40 requires that any agency of the state that is planning construction that could potentially affect streams, their banks, or their tributaries must obtain a wildlife certificate issued by the CDOW as part of the effort to protect all fish and wildlife resources in Colorado. A wildlife certificate also must be obtained for any project that could potentially affect a federally or state-listed threatened or endangered species, a Colorado species of concern, or the habitat of any of these species. The bill further states that all practicable efforts should be expended to avoid and minimize impacts to streams, riparian areas, and wetlands (CDOT 2003).

The Fish and Wildlife Coordination Act (16 U.S.C. §§ 661–667e) places similar requirements on activities involving a federal action. The federal action agency for the project is required to consult with the Service and CDOW. With specific regard to the impoundment or diversion of waters, the goal of the consultation should be to discuss conservation of wildlife by preventing loss of, and damage to, the wildlife resources and providing for the development and improvement of

these resources in connection with water resource development.

Executive Order (EO) 12962 relates to recreational fisheries. The intent of EO 12962 is to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide.

3.15.2 Study Area

For the purpose of this description of aquatic resources, the study area includes water bodies potentially affected by the NISP alternatives through either hydrologic or water quality changes. The altered flow regimes could potentially affect segments of the Cache la Poudre and the South Platte rivers. The segment of the Cache la Poudre River that may be affected by the NISP alternatives spans from the Munroe Canal diversion downstream to the confluence with the South Platte River. The segment of the South Platte River from the confluence with the Cache la Poudre River downstream approximately 2.5 miles to the Kersey gage also could be potentially affected by the alternatives. The Kersey gage was determined to be the downstream limit for the study area due to the numerous reaches of the South Platte River that frequently dry up below the Kersey gage. The study area additionally includes the proposed alternative locations of the off-channel reservoirs (Glade Reservoir, Cactus Hill Reservoir, and Galetton Reservoir).

3.15.3 Habitat Descriptions

Several past studies were used to describe habitat in the study areas as discussed in the NISP EIS Aquatic Biological Resources Technical Report (GEI 2006d).

3.15.3.1 Cache la Poudre River

Habitat data for the segment of the Cache la Poudre River within the project area are limited. A 1982 study conducted from April through November between Laporte and Greeley on the Cache la Poudre River concluded that river depths were variable, ranging from 0.3 to 2.3 feet. Widths ranged from 12 feet at the downstream site to 82 feet at one of the more upstream sites near Fort Collins (Propst 1982).

Bestgen and Fausch (1993) also briefly described habitat in the Cache la Poudre River from Fort Collins to Greeley. Much of this reach of the river was described as being channelized, with incised banks and limited riparian vegetation. The two upstream sites were noted as having diverse habitat, with all other sites described as having moderately diverse to homogenous habitat. Cobble, gravel, and sand were the dominant substrates. Several of the sites were also described as having high levels of silt and embeddedness.

The NAWQA surveyed the habitat at a single site on the Cache la Poudre River located near the upstream end of the study area in August of 1993 and 1994 (USGS 2003). Channel widths recorded at various transects during those two years ranged from 66 to 129 feet. Streambanks were rated as fairly stable for both years, with greater than 50 percent of the bank surface covered with vegetation or gravel. The dominant substrate types were listed as cobble, sand, and boulders, with no siltation noted in either year. Embeddedness at various transects differed between the two years of the study. In 1993, 51 to 75 percent of the gravel, cobble, and boulder substrate was covered by fine sediment. In 1994, 26 to 50 percent of the gravel, cobble, and boulder substrate was covered by fine sediment. The habitat at this site was described as having no woody snags or undercut

banks, and little overhanging vegetation (USGS 2003).

Habitat observations made during the collection of supplemental data in August and November 2005 noted that widths at survey sites on the Cache la Poudre River ranged from 16 feet to 78 feet. Water levels were notably low at all sites downstream of I-25 (GEI 2006d).

3.15.3.2 South Platte River

Habitat data for the segment of the South Platte River downstream of its confluence with the Cache la Poudre River are very limited. Propst (1982) listed a survey site near Kersey as having an elevation of 4,627 feet, with a water depth of 2 feet and a width of 155 feet. The habitat within a segment of the South Platte River near Kersey was surveyed by NAWQA in 1993 and 1994 (USGS 2003). The channel width of various transects within this segment ranged from 100 to 304 feet. Bank stability was moderate, with 25 to 49 percent of the left bank and 50 to 79 percent of the right bank surface covered with vegetation or gravel. The substrate was described as mainly sand and gravel. Woody snags, overhanging vegetation, and undercut banks were present, but not in significant amounts.

3.15.3.3 Reservoir Sites

The proposed off-channel reservoir sites for Glade Reservoir, Cactus Hill Reservoir, and Galeton Reservoir do not have permanent surface water or aquatic resources. These locations are dry or nearly dry most of the time. Therefore, these areas do not provide habitat for fish or benthic invertebrates.

3.15.4 Fish Populations

The Cache la Poudre River contains a cold water fishery from about the western edge of Fort Collins at Shields Street upstream, and a warm water fishery

from Shields Street downstream. This section discusses studies that have been conducted since 1978 on fish populations in the Cache la Poudre River in areas that could be affected by NISP.

3.15.4.1 Cache la Poudre River

From 1978 to 1980, Propst (1982) collected fish from six sites on the Cache la Poudre River ranging from above Fort Collins to upstream of Greeley. Twelve fish species were collected from all sites combined (Table 3-21).

Bestgen and Fausch surveyed for fish at 10 sites on the Cache la Poudre River ranging from Fort Collins to Greeley over three study periods from 1970 to 1994 in the spring, summer, and fall (Bestgen and Fausch 1993; Nesler et al. 1997; CDOW 2006). Over the three study periods, 32 fish species were collected (Table 3-21). Species composition during all three periods was similar. Based on the data from all three sources, white sucker was collected from every site. Common carp, johnny darter, fathead minnow, longnose dace, and sand shiner also were commonly collected, occurring at 80 percent or more of the sites during each time period. Central stoneroller, channel catfish, mosquitofish, and smallmouth bass were collected infrequently at the Cache la Poudre sites during each time period.

None of the species collected during Bestgen and Fausch's (1993) study are listed as federally endangered or threatened; however, two of the species collected during Bestgen and Fausch's (1993) study are listed as threatened in the State of Colorado—the brassy minnow and the common shiner. Both of these species were noted as having decreased in occurrence and abundance at all sites included in the study. Bestgen and Fausch (1993) suggested that increased siltation and declining flows were likely playing a role in their decrease.

Three Iowa darters, a state species of concern in Colorado, were first collected from a site upstream of Greeley during studies in fall 1993 (CDOW 2006). One Iowa darter was collected in the spring of 1994, and three darters were collected in fall 1994 (CDOW 2006). Additional information on these species is in the Species of Concern section.

The 1994 data summarized by Nesler et al. (1997) evaluated the presence or absence of multiple size classes of each species for the Cache la Poudre River sites. Size classes are groups of fish of similar sizes. Most native species had multiple size classes present, indicating that those species were reproducing in the Cache la Poudre River. The status of brown trout and Iowa darters was listed as unknown. Black crappie, bluegills, largemouth bass, mosquitofish, plains killifish, rainbow trout, and yellow perch did not have multiple size classes present and were not likely reproducing in the river. Bestgen and Fausch (1993) did not provide data on age groups for the fish species present, but noted similar results in that many of the nonnative species (black crappie, bluegills, pumpkinseeds, largemouth bass, smallmouth bass, white crappie, and yellow perch) were generally represented by young individuals that had likely escaped from reservoirs and ponds that maintain forage and game fish.

Fish surveys continued to be conducted from 1993 through 1995 by NAWQA (USGS 2003). NAWQA surveyed one segment of the Cache la Poudre River located near the upstream end of the study area. Over the 3-year study period, five fish species were collected (Table 3-21). Brown trout, longnose dace, and longnose sucker were collected every year, while rainbow trout and yellow perch were found in very low numbers during these surveys and were collected less frequently.

Fausch surveyed fish populations at sites on the Cache la Poudre River from 1995 and 1996 at sites located near Fort Collins. Bestgen surveyed some of the same sites as well as some additional sites from 1997 through 2005 (CDOW 2006). During these surveys, 27 fish species, as well as one hybrid type, were collected (Table 3-21). As was seen in several of the previous surveys, fathead minnow was the dominant species during most of these sampling efforts. Longnose dace, white sucker, and sand shiner also were abundant and frequently collected. Fausch collected three plains minnow, a species listed as endangered in Colorado, from two sites during surveys in 1996. Additionally, a single Iowa darter, a state species of concern, was collected in 2001 by Bestgen (CDOW 2006).

The most recent data available for the Cache la Poudre River was collected in the late summer and fall of 2005 by the CDOW and Chadwick Ecological Consultants (GEI 2006d). Nine sites were surveyed during supplemental data collection for this EIS, ranging from near the mouth of the Poudre Canyon to near the confluence with the South Platte River. Twenty-five fish species were collected from the segment of the Cache la Poudre River in the study area (Table 3-21).

The number of fish species collected at each site ranged from a low of six fish species collected at sites upstream of Fort Collins, to a high of 16 species collected near the confluence with the South Platte River. The number of species collected at each site showed a significant increasing trend in a downstream direction. Total fish densities ranged from 964 fish/acre to 23,729 fish/acre. While fish densities were generally higher at the more upstream and downstream sites and lower at the middle sites, there was no significant longitudinal trend.

Table 3-21. Fish Population Data (Presence/Absence) for the Cache la Poudre River, 1970–2005.

Species/Date	1978–1980	1970–1994	1993–1995	1995–2005	2005
Bigmouth shiner ¹	X	X	--	X	--
Black bullhead	X	X	--	X	X
Black crappie	--	X	--	X	X
Bluegill	--	X	--	X	X
Brassy minnow	--	X	--	--	--
Brook stickleback	--	X	--	X	X
Brown trout	X	X	X	X	X
Central stoneroller	--	X	--	--	--
Channel catfish	--	X	--	--	--
Common carp	X	X	--	X	X
Common shiner	--	X	--	--	--
Creek chub	--	X	--	X	X
Fathead minnow	X	X	--	X	X
Gizzard shad	--	--	--	X	X
Green sunfish	X	X	--	X	X
Hybrid sunfish	--	--	--	X	--
Iowa darter	--	X	--	X	--
Johnny darter	X	X	--	X	X
Largemouth bass	--	X	--	X	X
Longnose dace	X	X	X	X	X
Longnose sucker	X	X	X	X	X
Mosquitofish	--	X	--	X	X
Mountain whitefish	--	X	--	--	X
Orangespotted sunfish	--	X	--	X	X
Plains killifish	X	X	--	--	--
Plains minnow	--	--	--	X	--
Plains topminnow	--	X	--	X	--
Pumpkinseed	--	X	--	X	--
Rainbow trout	--	X	X	X	X
Red shiner	--	X	--	X	X
Sand shiner	X	X	--	X	X
Smallmouth bass	--	X	--	--	X
Walleye	--	--	--	--	X
White crappie	--	X	--	X	X
White sucker	X	X	--	X	X
Yellow perch	--	X	X	X	X

¹Native species in bold.

Source: Propst 1982; Bestgen and Fausch 1992; Nesler et al. 1997; USGS 2003; CDOW 2006; GEI 2006d.

Total fish biomass ranged from 30 lbs/acre at Fort Collins to 509 lbs/acre upstream of Greeley. The high biomass at the site upstream of Greeley was associated with the relatively large number of carp collected at that site, while the low biomass at the Fort Collins site was associated with a high number of small fish, mainly longnose dace, collected at this site. There were no significant longitudinal trends in biomass along the length of the Poudre River in the study area.

Multiple size classes of most native fish species and some introduced species were collected from the Cache la Poudre River in 2005, indicating that these species are reproducing. Of the native species collected, black bullhead, brook stickleback, creek chub, red shiner, and walleye were collected in such low numbers that determining if they are reproducing in the Cache la Poudre River was not possible. All other native species had multiple size classes present. Introduced species such as bluegill, brown trout, common carp, largemouth bass, mosquitofish, and rainbow trout also had multiple size classes present at one or more sites, indicating reproduction is occurring for these species. Brown trout and rainbow trout have been stocked in this section of the Cache la Poudre River in the past, but no stocking of either species has occurred since 1992 (McKissick, pers. comm. 2006).

The supplemental and existing data indicate that 35 species have been collected in the Cache la Poudre River, as well as one hybrid fish (Table 3-21). Of these species, 23 are native to the South Platte River Basin. The data suggest that fish species composition has changed over the 1978–2005 time period, with some species moving into the area and some not being collected for many years. Gizzard shad appears to have moved into the study area recently because it was collected for the first time in 2001 and again in 2003 and 2005 at several sites. Mosquitofish also appears to be establishing

populations in the study area, as a single mosquitofish was collected in 1994 for the first time, with higher numbers collected in all surveys from 2001 through 2005.

Several other species have not been collected in the study area for over 10 years, and are unlikely to still inhabit this segment of the Cache la Poudre River. Brassy minnow, a threatened species in Colorado, has not been collected since a single minnow was found in 1994 (CDOW 2006). From 1984 to 1992, Bestgen and Faust (1993) collected only two brassy minnow at the study's most downstream site, and state that the brassy minnow collected before 1984 was possibly misidentified. Additionally, common shiner, central stoneroller, channel catfish, and plains killifish have not been collected prior to 1994. Common shiner is listed as threatened by the State of Colorado.

Two other sensitive species were collected. Three plains minnow, endangered in the State of Colorado, were collected during a 1996 survey, but have not been collected in any survey before or since then. Iowa darter, a state species of concern, was last collected within the study area in 2001, when a single darter was found (CDOW 2006). Other species, mainly native species, have been collected consistently in relatively high abundances throughout the 1978–2005 time period, most notably fathead minnow and longnose dace. Brown trout was frequently collected in the upper portion of the study area as well, and common carp, longnose sucker, fathead minnow, sand shiner, and white sucker have been found at most sites and years in relatively high numbers.

3.15.4.2 South Platte River

Limited data were available for the South Platte River downstream of the confluence with the Cache la Poudre River. Propst (1982) surveyed a single

site on the South Platte River near Kersey in November 1980. Fourteen fish species were collected; 10 of which are native species. Bigmouth shiner was collected in the highest numbers, followed by fathead minnow. All other species were collected at relatively low numbers. Brown trout were listed as occurring in this study, but numbers were not given (Propst 1982).

Approximately the same segment of the South Platte River near Kersey was surveyed annually by NAWQA (USGS 2003) in 1993–1995, 1998, and 2002 to 2004. Nineteen species were collected at this site over the 6 years of surveys; 14 of which are native to the South Platte River Basin (Table 3-22). Seven of these species were collected every year: common carp, fathead minnow, longnose dace, longnose sucker, red shiner, sand shiner, and white sucker.

Based on unpublished data from the CDOW (2006), a site on the South Platte River near Kersey was also surveyed in 1994 and 2004. Seventeen species, including 11 species native to the South Platte River Basin, were collected in 1994; eight species, all of which are native, were collected in 2004 (Table 3-22). Fathead minnow was numerically dominant in 1994, with common carp, longnose sucker, sand shiner, and white sucker collected in high numbers as well. Sand shiner was the most abundant species during the 2005 survey, and bigmouth shiner was fairly common. Several of the species collected in 1994 were not collected in 2004, most notably fathead minnow, which was collected in high abundances in every other survey recorded for this section of the South Platte River. Black crappie, bluegill, green sunfish, plains killifish, and yellow perch were collected at low abundances in both surveys (CDOW 2006).

Based on these studies, a total of 21 species have been collected in the South Platte River in the study area since 1980. Many of the native species have been consistently present in this section of the South Platte River for the sampling period from 1980 through 2004. Carp and largemouth bass, two introduced species, have also been collected during most or all years of sampling. Two species, gizzard shad and mosquitofish, appear to have colonized this segment of the South Platte River recently. Gizzard shad, a native species, and mosquitofish, an introduced species, were both first collected in 1994. They have been collected in surveys almost every year since then. Brassy minnow, a species that is threatened in the State of Colorado, has not been collected since 1980, when two were collected by Propst (1982); therefore, the brassy minnow may no longer inhabit this portion of the South Platte River. Iowa darter, a state species of concern in Colorado, were collected in low numbers in 2002 and 2003, suggesting that a small population may exist within the study area. However, because Iowa darter was not collected in either of the 2004 surveys or any survey conducted prior to 2002, the darters collected in those years could have been displaced from an upstream or tributary population during a high flow event rather than being residents of this segment of the South Platte River.

3.15.5 Macroinvertebrate Populations

Macroinvertebrates (or benthic invertebrates) are invertebrates (organisms that lack spines) that are large enough to be seen without a microscope. Macroinvertebrates include organisms such as worms, crustaceans, and the nymphs and larvae of insects, and are commonly found in aquatic habitats on the bottoms of streams and lakes.

Table 3-22. Fish Population Data (Presence/Absence) for the South Platte River, 1980–2004.

Species/Date	1980	1993–1995	1994	1998	2002–2004	2004
Bigmouth shiner ¹	X	--	--	--	X	X
Black crappie	X	X	X	--	--	--
Bluegill	--	X	X	--	--	--
Brassy minnow	X	--	--	--	--	--
Brook stickleback	X	X	X	--	X	--
Brown bullhead	X	--	--	--	--	--
Common carp	X	X	X	X	X	--
Creek chub	X	X	X	--	X	X
Fathead minnow	X	X	X	X	X	--
Gizzard shad	--	X	X	X	X	X
Green sunfish	X	X	X	X	X	X
Iowa darter	--	--	--	--	X	--
Largemouth bass	X	X	X	X	X	--
Longnose dace	--	X	X	X	X	X
Longnose sucker	X	X	X	X	X	--
Mosquitofish	--	X	X	X	X	--
Plains killifish	X	X	X	X	X	X
Red shiner	--	X	X	X	X	X
Sand shiner	X	X	X	X	X	X
White sucker	X	X	X	X	X	--
Yellow perch	--	X	X	X	--	--

¹Native species in bold.

Source: Propst 1982; NAWQA 2003; CDOW 2006.

3.15.5.1 Cache la Poudre River

Shieh et al. (1999) collected macroinvertebrate samples from the Cache la Poudre River quarterly from 1992 to 1995 at eight sampling sites, with locations ranging from approximately Laporte to Greeley. A total of 95 macroinvertebrate taxa were identified during the 4-year period, with between 18 and 20 taxa, or species, identified at each site during the study. The most upstream site had the highest number of total taxa, number of Ephemeroptera, Plecoptera, Trichoptera (EPT) taxa (mayflies, stoneflies, and caddisflies) and diversity values, but had the lowest abundance. Diversity values,

measured with the Shannon-Weaver diversity index, a common measure of the biodiversity of a community, were greater than or equal to 2.50 at all sites, indicating that healthy invertebrate communities inhabit the Cache la Poudre River within the study area. Generally, diversity decreased consistently downstream, but the other parameters did not show the same pattern. EPT taxa, which are sensitive to a wide range of pollutants, composed between 24 and 90 percent of the total taxa at each site (Shieh et al. 1999).

NAWQA collected macroinvertebrate samples from 1993 to 1995 from four sites on the Cache la Poudre

River with site locations ranging from upstream of Fort Collins to Greeley (USGS 2003). Generally, values for all parameters were high, with diversity values well above the 2.50 diversity value threshold that indicates healthy invertebrate communities. The most downstream site near Greeley had low total abundance and number of EPT taxa compared to the other sites sampled, but total number of taxa and diversity remained high. From 6 to 60 percent of the invertebrate taxa at each site were pollution-intolerant EPT taxa.

Consistent with the previous two studies, the supplemental data collected in 2005 showed high mean macroinvertebrate density at all sites on the Cache la Poudre River, with values ranging from 1,241 organisms/ft² just upstream of Greeley to 6,844 organisms/ft² at Greeley (GEI 2006d). A total of 131 species were identified. The number of taxa found at each site ranged from 34 taxa collected at a site located midway between I-25 and U.S. 85, to 55 taxa collected in Fort Collins. Mayflies (Ephemeroptera) were typically the numerically dominant invertebrate group at the upstream sites, with true flies (Diptera) generally dominating the more downstream sites.

The number of EPT taxa collected at each site ranged from five taxa at I-25 to 15 taxa at the upstream sites, and made up from 16 percent to 29 percent of the total number of taxa. Shannon-Weaver diversity values were near 3.0 or higher, well above the 2.50 threshold value that indicates healthy macroinvertebrate populations. The results of linear regression analysis, a statistical analysis, showed no significant longitudinal trends in macroinvertebrate density. The number of taxa and EPT taxa showed significant decreasing trends in a downstream direction.

Based on the 2005 data, as well as the earlier data, abundant and diverse macroinvertebrate populations

inhabit the Cache la Poudre River within the study area. However, linear regression analysis results show that while density remains high at all study sites, the number of EPT taxa decreases at the downstream sites. The three upstream sites near Fort Collins are dominated by EPT taxa, particularly mayflies (Ephemeroptera). Stoneflies (Plecoptera) were only collected at the upper sites. These data indicate that the water quality in the upstream portion of the study area is suitable to support these pollution-intolerant taxa. Further downstream, these pollution-intolerant taxa become less common as they are replaced with more pollution-tolerant taxa such as true flies (Dipterans). These changes in the macroinvertebrate community composition, as well as the trend toward a decreasing number of total taxa in a downstream direction, are likely due to two factors: decreasing water quality as the Cache la Poudre River passes through the towns of Fort Collins and Greeley, and warmer water temperatures occurring at the more downstream sites.

3.15.5.2 South Platte River

Existing macroinvertebrate data for the segment of the South Platte River downstream of its confluence with the Cache la Poudre River are limited to a survey conducted by NAWQA at a site near Kersey in 1993 (USGS 2003). This survey targeted the richest habitat available according to NAWQA's procedures (Moulton et al. 2002). A total of 11,392 organisms were collected, belonging to 54 different taxa. Seventeen of those taxa (31 percent) were EPT taxa. The Shannon-Weaver diversity value calculated for this site was 3.58, well above the 2.50 threshold value. While these data are limited, they indicate that a healthy and diverse macroinvertebrate population inhabits this section of the South Platte River.

3.16 SPECIES OF CONCERN

Species of concern include plants, wildlife, and fish species protected under the ESA as threatened, endangered, or candidates for listing under ESA. Also included are the federally protected bald eagle; species listed by the CDOW as state threatened, endangered, or of special concern; and species identified by the CNHP as rare, vulnerable, or imperiled in Colorado. The following sections summarize species of concern with the potential to occur in the study areas. Study area descriptions only include species of concern of particular relevance. A detailed description of species of concern expected to occur in study areas is provided in the Species of Concern Technical Report (ERO 2008d).

3.16.1 Regulatory Framework

Federally threatened and endangered species are protected under the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). Potential effects to a federally listed species or its designated critical habitat resulting from a project with a federal action require the federal action agency to consult with the Service under Section 7 of the ESA. Consultations are not required for effects to candidate species; however, if a species were to become listed during project planning or construction, consultation with the Service would be required. The Corps submitted a Biological Assessment to the Service that addresses potential effects to federally listed species as part of the Section 7 consultation process (Appendix B).

Colorado maintains a list of species determined to be endangered or threatened within the State (Colo. Rev. Stat. Ann. §§ 33-2-102-106). State-listed wildlife species are protected by Colorado wildlife statutes concerning nongame and endangered species conservation, which are enforced by the

CDOW (Colo. Rev. Stat. Ann. §§ 33-2-101-108). Although state statutes prohibit the take, possession, and sale of a state-listed species, it does not include protection of their habitat.

The Fish and Wildlife Coordination Act requires the federal action agency to consult with the Service and the CDOW on issues related to conservation of wildlife resources for federal projects resulting in modifications to waters or channels of a body of water (16 U.S.C. §§ 661-667e). State-listed species would likely be considered during such consultation with the CDOW.

3.16.2 Federally Listed Threatened and Endangered Species

Table 3-23 shows federally listed threatened, endangered, and candidate species that the Service has identified as potentially occurring in each study area (Service 2006b; CDOW 2006). Habitat potential of all study areas is rated for each species according to the quantity, quality, and type of habitat available. On July 9, 2007, the bald eagle was removed from the list of threatened and endangered species (72 Fed. Reg. 32346 [July 9, 2007]). The bald eagle continues to be federally protected under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA), and is also discussed in this section.

The black-footed ferret, Preble's meadow jumping mouse (Preble's), Colorado butterfly plant (CBP), and Ute ladies'-tresses orchid (ULTO) are the only federally listed species potentially occurring in the study areas. The bald eagle also potentially occurs in the study areas. The following sections provide a description of the habitat requirements, distribution, and breeding and foraging behavior of these species. Only species potentially occurring in the study areas are discussed in this section. Complete descriptions

Table 3-23. Federally Listed Endangered and Threatened Species Potentially Occurring in Each Study Area.

Common Name	Scientific Name	Federal Status ^{1,2}	Habitat	Study Area				
				Glade	U.S. 287 Realignment	Cactus Hill	Galeton	Pipelines and other Facilities
Mammals								
Canada lynx	<i>Lynx canadensis</i>	T	Spruce/fir forests	0	0	0	0	0
Black-footed ferret	<i>Mustela nigripes</i>	E	Rangeland and shortgrass prairie with large prairie dog colonies	0	0	0	2	0
Preble’s meadow jumping mouse	<i>Zapus hudsonius preblei</i>	T	Wetland and riparian areas with shrubs	3	1	0	0	3
Birds								
Bald eagle	<i>Haliaeetus leucocephalus</i>	T ²	Trees and cliffs, rivers, large lakes; forages in rivers and lakes	1	0	0	0	3
Mexican spotted owl	<i>Strix occidentalis lucida</i>	T	Old growth forests with cliffs	0	0	0	0	0
Plants								
Colorado butterfly plant	<i>Gaura neomexicana coloradensis</i>	T	Floodplains	1	1	0	0	2
Ute ladies’-tresses orchid	<i>Spiranthes diluvialis</i>	T	Floodplains and subirrigated wetlands	1	1	0	0	2

¹E = Endangered; T = Threatened

²The bald eagle has been removed from the list of threatened and endangered wildlife and is now protected under the MBTA and BGEPA.

Habitat rating:

0 = No habitat

1 = Limited habitat present, species unlikely to occur

2 = Potential breeding and foraging habitat for wildlife, and potential habitat for plants

3 = Known to occur

Source: Service 2006b.

of federally threatened, endangered, and candidate species occurring in Larimer and Weld counties are provided in the Species of Concern Technical Report (ERO 2008d).

3.16.2.1.1 Black-footed Ferret

The black-footed ferret is listed as endangered under the ESA. The black-footed ferret is associated with prairie dog colonies upon which it depends for food and shelter. Over the past century, prairie dog distribution has been substantially reduced due to

habitat loss, plague, poisoning practices, and loss of prairie dog habitat (Service 1993). Current Service guidelines for potential black-footed ferret habitat require surveys for any black-tailed prairie dog town or complex of greater than 80 acres (Service 1989).

3.16.2.1.2 Preble's Meadow Jumping Mouse

Preble's is listed as threatened under the ESA. Typically, this species is found in riparian corridors near forests, or where tall shrubs and low trees provide adequate cover with low undergrowth consisting of grasses and forbs, and in open wet meadows. Along Colorado's Front Range, Preble's is found below 7,500 feet in elevation, generally in lowlands with medium to high moisture along permanent or intermittent streams and irrigation canals (Meaney et al. 1997). Critical habitat has been designated for Preble's (68 Fed. Reg. 37276 [June 23, 2003]). The Service has proposed amending the listing for Preble's to maintain its federally threatened status in Colorado and to remove it from the list of species protected by the ESA in Wyoming (72 Fed. Reg. 62991 [November 7, 2007]).

3.16.2.1.3 Bald Eagle

The bald eagle is a large North American bird of prey with a historical distribution throughout most of the U.S. The bald eagle was listed as an endangered species in 1978. Population declines were attributed to habitat loss, the use of organochlorine pesticides, and mortality from shooting. Since the species was listed in 1978, the population trend for the bald eagle has been increasing. The bald eagle was downlisted from endangered to threatened in 1995. In 2006, in anticipation of delisting, the Service published new draft guidelines for bald eagle management (71 Fed. Reg. 8238 [February 16, 2006]). The bald eagle was eventually delisted in 2007; however, it is still protected under the MBTA and the BGEPA.

The bald eagle is primarily a winter resident in Colorado, although nesting along the Colorado Front Range has increased in recent years. Most nesting in Colorado occurs near lakes or reservoirs or along rivers. The eagle feeds primarily on fish and waterbirds, but also on small mammals and mammal carcasses, occasionally stealing prey from other raptors (Service 1981; Winternitz 1998). In Colorado, prairie dogs are often among the primary food sources for the nesting and wintering bald eagles (DOE/Service 2001; RMBO 2004, 2005). Typical bald eagle nesting habitat consists of forests or wooded areas that contain many tall, aged, dying, and dead trees (Martell 1992).

3.16.2.1.4 Colorado Butterfly Plant

The CBP is a short-lived perennial herb found in moist areas of floodplains. It occurs on sub-irrigated, alluvial soils on level or slightly sloping floodplains and drainage bottoms at elevations of 5,000 to 6,400 feet. Colonies are often found in low depressions or along bends in wide, active, meandering stream channels that are periodically disturbed. Historically, the main cause of disturbance was probably flooding (Service 2004). The CBP flowers from June to September and produces fruit from July to October (Spackman et al. 1997).

This species is federally listed as threatened under the ESA and is found within a small area in southeastern Wyoming, western Nebraska, and north-central Colorado (NatureServe 2006). On August 6, 2004 critical habitat for CBP was proposed in southeastern Wyoming, southwest Nebraska, and in Larimer County in north-central Colorado (Service 2004). Historically, the CBP occurred along streams where natural flooding periodically scoured the riparian vegetation to create vegetation patterns suitable for the plant (Service 2004). The nearest known existing population of

CBP is in Soapstone Prairie, a Fort Collins natural area, in northern Larimer County (Mayo 2007).

3.16.2.1.5 Ute Ladies'-tresses Orchid

The ULTO is federally listed as threatened. This orchid occurs at elevations below 6,500 feet in moist to wet alluvial meadows, floodplains of perennial streams, and around springs and lakes where the soil is seasonally saturated within 18 inches of the surface. Generally, the species occurs where the vegetative cover is relatively open and not overly dense or overgrazed. Once thought to be fairly common in low elevation riparian areas in the interior western United States, ULTO is now rare (Service 1992b).

This species' decline appears to be related to drastic modification of riparian habitat by urbanization and stream channelization. Because of this decline, the Service listed this species as threatened under the ESA in 1992 (Service 1992a). When listing occurred, ULTO was only found in Colorado, Utah, and Nevada. Since then the species has been found in Wyoming, Montana, Nebraska, and Idaho. The largest known population occurs in Colorado. The nearest known population of ULTO occurs near the Glade to Horsetooth and Carter pipelines in Larimer County (Service 2007).

According to the Service (1992b), ULTO surveys must be conducted in appropriate sites below 6,500 feet in elevation and on perennial tributaries of the South Platte River. Surveys should be conducted during the blooming season (typically in August).

3.16.2.1.6 South Platte River Species

The Service has determined that historical and new depletions to the South Platte River Basin adversely affect federally listed species and their designated critical habitat along the Platte River in central Nebraska. These species are American burying beetle, least tern, pallid sturgeon, piping plover, Western prairie fringed orchid, and whooping crane, as well as the designated critical habitat for whooping crane and piping plover. These species and depletions associated with the alternatives are discussed in the Biological Assessment (Appendix B).

3.16.3 State Species of Concern

State species of concern include species that are not already protected under ESA but that are listed by the CDOW as state threatened, endangered, or of special concern; and species ranked as rare, vulnerable, or imperiled in the State by the Colorado Natural Heritage Program (CNHP). State species of concern potentially occurring in the study areas and their status are presented in Table 3-24.

Only state species of concern that have been observed from 2000 to present at the study areas are described below. A detailed description of species of concern potentially occurring in the study areas is provided in the Species of Concern Technical Report (ERO 2008d).

Table 3-24. State-Listed Endangered, Threatened, and Candidate Species, and CNHP Sensitive Species Potentially Occurring in Each Study Area.

Common Name	Scientific Name	State Status ¹	CNHP Rank ²	Habitat	Possible Location ³
Mammals					
Black-tailed prairie dog	<i>Cynomys ludovicianus</i>	SC	G3/4, S3	Rangeland; shortgrass prairie	All
Townsend's big-eared bat	<i>Plecotus townsendii</i>	SC	G4, S2	Woodlands with rocky outcrops	GL, U.S. 287, GL-HT, CP
Dwarf shrew	<i>Sorex nanus</i>		G4, S2	Alpine areas to shrubby, wooded foothills	GL, U.S. 287, GL-HT, CP
Swift fox	<i>Vulpes velox</i>	SC	G3, S3	Shortgrass prairie	GL, U.S. 287, GA, CH, SPWCP, PVC, AG
Birds					
Burrowing owl	<i>Athene cunicularia</i>	T	G4, S4	Rangeland and shortgrass prairie containing prairie dog colonies	All
Ferruginous hawk	<i>Buteo regalis</i>	SC	G4, S3	Shortgrass prairie	GL, U.S. 287, GA, CH, GL-HT, CP, SPWCP, PVC
McCown's longspur	<i>Calcarius mccownii</i>		G5, S2	Rangeland and shortgrass prairie	GA, CH, SPWCP, PVC
Chestnut-collared longspur	<i>Calcarius ornatus</i>		G5, S1	Shortgrass prairie	GA, CH, SPWCP, PVC
Mountain plover	<i>Charadrius montanus</i>	SC	G2, S2	Rangeland and shortgrass prairie	GA, CH, SPWCP
Peregrine falcon	<i>Falco peregrinus</i>	SC	G4, S2	Steep cliffs and canyons	GL, U.S. 287, GL-HT
Black-necked stilt	<i>Himantopus mexicanus</i>		G5, S3	Freshwater lakes, ponds, and marshes	GL, U.S. 287
Long-billed curlew	<i>Numenius americanus</i>	SC	G5, S2	Native grassland and shortgrass prairie	GA, CH, SPWCP
Reptiles					
Common gartersnake	<i>Thamnophis sirtalis parietalis</i>	SC	NI	Wetland and riparian areas	GL, U.S. 287, CH, AG, GL-HT, CP, PVC, SPWCP, P-SP
Amphibians					
Northern leopard frog	<i>Rana pipiens</i>	SC	G5, S3	Wetlands	GL, U.S. 287, CH, AG, GL-HT, CP, PVC, SPWCP, P-SP
Fish					
Brassy minnow	<i>Hybognathus hankinsoni</i>	T	G5, S3	Small, cool streams with sand or gravel substrate and aquatic vegetation	P-SP

Common Name	Scientific Name	State Status ¹	CNHP Rank ²	Habitat	Possible Location ³
Common shiner	<i>Luxilus cornutus</i>	T	G5, S2	Small, cool streams with sand or gravel substrate and aquatic vegetation	P-SP
Iowa darter	<i>Etheostoma exile</i>	SC	G5, S3	Cool, clear streams of low to medium gradients with overhanging vegetation and undercut banks	P-SP
Insects					
Simius roadside skipper	<i>Amblyscirtes simius</i>		G4, S3	Open pinyon-juniper and shortgrass prairie dominated by blue grama	GL, GL-HT, CP
Arogos skipper	<i>Atrytone arogos</i>		G3/4, S2	Grasslands with abundance of big bluestem	GL, U.S. 287, GL-HT, CP
Dusted skipper	<i>Atrytonopsis hianna</i>		G4/5, S2	Mid-tallgrass prairie with abundance of big and little bluestem	GL, U.S. 287, GL-HT, CP
Moss' elfin	<i>Callophrys mossii</i>		G3/4, S2/3	Steep cliffs and canyons containing yellow stonecrop	GL, U.S. 287
Hops feeding azure	<i>Celastrina humulus</i>		G2/3, S2	Foothills, canyons usually with abundance of hops	GL, GL-HT, CP
Mottled duskywing	<i>Erynnis martialis</i>		G3/4, S2/3	Scrub-oak woodlands with abundance of buckbrush	GL, U.S. 287, GL-HT, CP
Two-spotted skipper	<i>Euphyes bimacla</i>		G4, S2	Sedge dominated meadows	GL, U.S. 287, GL-HT, CP, PVC, SPWCP
Ottoe skipper	<i>Hesperia ottoe</i>		G3/4, S2	Mid-tallgrass prairie with abundance of big bluestem	GL, U.S. 287, GL-HT, CP
Rhesus skipper	<i>Polites rhesus</i>		G4, S2/3	Shortgrass prairie dominated by blue grama	GL, U.S. 287, GA, GH, GL-HT, CP, SPWCP, PVC
Smoky-eyed brown butterfly	<i>Satyrodes eurydice fumosa</i>		G5, S1	Tallgrass prairie with abundance of sedges	GL, U.S. 287, GL-HT, CP, PVC, SPWCP
Regal fritillary	<i>Speyeria idalia</i>		G3, S1	Tallgrass prairie	GL, U.S. 287, GL-HT, CP, PVC, SPWCP

Common Name	Scientific Name	State Status ¹	CNHP Rank ²	Habitat	Possible Location ³
Plants ⁴					
Lavender hyssop	<i>Agastache foeniculum</i>		G4/5, S1	Woodlands, stream bank, and riparian habitat within shortgrass prairie	GL, U.S. 287, CP
Rocky Mountain sedge	<i>Carex saximontana</i>		G5, S1	Pine forests, riparian woodlands	GL
Bell's twinpod	<i>Physaria bellii</i>		G2, S2	Dry, loose shale	GL, U.S. 287, GL-HT, CP
American currant	<i>Ribes americanum</i>		G5, S2	Moist woods and riparian woodlands at the base of foothills	GL, P-SP

¹E = State Endangered T = State Threatened SC = Species of Concern

²**CNHP Ranks:**

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction. (Critically endangered throughout its range.)

G2 = Imperiled globally because of rarity (6 to 20 occurrences) or because of other factors demonstrably making it very vulnerable to extinction throughout its range. (Endangered throughout its range.)

G3 = Vulnerable throughout its range or found locally in a restricted range (21 to 100 occurrences). (Threatened throughout its range.)

G4 = Apparently secure globally, though it might be quite rare in parts of its range, especially at the periphery.

GU = Unable to assign rank due to lack of available information.

S1 = Critically imperiled in state because of extreme rarity (5 or fewer occurrences, or very few remaining individuals, or because of some factor of its biology making it especially vulnerable to extirpation from the State. (Critically endangered in state.)

S2 = Imperiled in state because of rarity (6 to 20 occurrences) or because of other factors demonstrably making it very vulnerable to extirpation from the State. (Endangered or threatened in state.)

S3 = Vulnerable in state (21 to 100 occurrences).

S4 = Apparently secure in the State, though it might be quite rare in parts of its range, especially at the periphery.

SH = Extirpated or extinct from the State.

NI = No information.

T(1-5) = Trinomial Rank – Used for subspecies. These species are ranked on the same criteria as G1 to G5.

³**Study Area Location Codes:**

Glade Reservoir = GL, Galeton Reservoir = GA, Cactus Hill Reservoir = CH, Glade to Horsetooth pipeline = GL-HT, U.S. 287 realignment = U.S. 287, CP = Carter pipeline, South Platte Water Conservation Project = SPWCP, Poudre Valley canal = PVC, Agricultural Transfer = AG, Poudre–South Platte River corridor = P-SP.

⁴Only includes plants ranked as S1 or S2.

3.16.3.1.1 Black-tailed Prairie Dog

The black-tailed prairie dog is a state species of special concern and was, until recently, a federal candidate species for listing as threatened under the ESA (69 Fed. Reg. 15951217 [August 18, 2004]). It is commonly considered a “keystone” species of the short and mesic grasslands systems because black-tailed prairie dog activities (burrowing and intense grazing) provide food and shelter for many other

grassland species, and this species has a large effect on community structure and ecosystem function (Power et al. 1996). Species such as the black-footed ferret, burrowing owl, prairie rattlesnake, and mountain plover are closely linked to prairie dog burrow systems for food and/or cover. The black-tailed prairie dog provides an important prey resource for numerous mammalian predators including the American badger, coyote, and red fox,

as well as the bald eagle, golden eagle, ferruginous hawk, and other raptors. Black-tailed prairie dog colonies occur in nearly every study area, usually in grazed pasturelands.

3.16.3.1.2 Swift Fox

The swift fox is a state species of concern. The distribution of the swift fox includes the grasslands of the Great Plains including eastern Colorado (Fitzgerald et al. 1994). Dens are usually located on sites dominated by native shortgrass prairie species such as blue grama and buffalo grass. Swift fox is sometimes associated with prairie dog towns although it generally excavates its own den (Fitzgerald et al. 1994). Grasslands of all the study areas provide swift fox habitat.

3.16.3.1.3 Burrowing Owl

The burrowing owl is a small migratory owl that occupies prairie dog towns in Colorado during its summer breeding season. The burrowing owl has been listed as threatened by the CDOW and is protected under the MBTA, which prohibits the killing of burrowing owls or destruction of their active nests. The burrowing owl is typically present in Colorado between March 1 and October 31. Potential burrowing owl habitat in the study areas occurs where prairie dog colonies are located.

3.16.3.1.4 Common Gartersnake

The common gartersnake occurs within the South Platte River drainage below 6,000 feet in northeastern Colorado (Hammerson 1999) and is listed as a state species of concern. This species is among the widest ranging in the world and occurs from the west coast to east coast and north into the Arctic Circle. In Colorado, this snake is essentially restricted to aquatic and riparian habitats within floodplains and inhabits marshes, ponds, and stream edges.

3.16.3.1.5 Northern Leopard Frog

The northern leopard frog is considered globally secure by the CNHP but has been declining in Colorado and is listed as a state species of concern (CNHP 2004). In Colorado, this species typically inhabits the banks and shallow portions of wetlands, ponds, lakes, streams, and other permanent bodies of water from below 3,500 feet to above 11,000 feet (Hammerson 1999). This species breeds in shallow, nonflowing portions of permanent water bodies and in seasonally flooded areas.

3.16.3.1.6 Brassy Minnow

The brassy minnow was last collected in the Cache la Poudre River between 1984 and 1992 by Bestgen and Fausch (1993), and in the South Platte River in 1980 by Propst (1982). This minnow occurs throughout southern Canada and the northern United States south to Colorado and Kansas, with healthy population levels existing within most of that range. Colorado, Illinois, Kansas, Vermont, and Missouri list their brassy minnow populations as vulnerable or imperiled (NatureServe 2006). In Colorado, the brassy minnow is native to the South Platte River and Republican River basins. While this species may be found in the South Platte River itself, it likely uses the river mainly as a conduit for connecting tributary stream populations (CDOW 1992). Within the South Platte River Basin, populations remain in the St. Vrain Creek, Cache la Poudre River, Lonetree Creek, Pawnee Creek, and the lower South Platte River. Preferred habitat for the brassy minnow includes small, cool streams with sand or gravel substrate and aquatic vegetation (CDOW 1992).

In 1998, brassy minnows were listed as threatened by the Colorado Wildlife Commission. Factors leading to the listing of this species included documented declines in distribution in Colorado and dependence upon aquatic habitat impacted by land and water development (CDOW 1992). As of 2005,

brassy minnows were considered to exist at low population levels in the State, and were considered one of Colorado's species of most concern (CDOW 2005).

3.16.3.1.7 *Common Shiner*

The common shiner was last collected in the Cache la Poudre River within the project area by Bestgen and Fausch (1993) during their 1970–1992 study period. This species is native to the South Platte River Basin in Colorado and widely distributed outside of Colorado. The common shiner occurs from southern Canada south to Virginia, Ohio, Michigan, Wyoming, and Colorado, with populations considered stable throughout most of its range, particularly in the north (NatureServe 2006). Currently, common shiner populations occur in Colorado only in the upper South Platte River tributary system and the St. Vrain River system. As Colorado is at the southern edge of the range for the common shiner, it generally occurs as isolated or glacial relict populations. Common shiner preferred habitat includes cool, clear streams with moderate gradient, gravel substrate, and overhanging riparian vegetation. It is particularly susceptible to habitat changes due to siltation (CDOW 1992).

The common shiner was listed as threatened by the Colorado Wildlife Commission in 1998. Although it appeared to be widely distributed in transition zone streams throughout the Front Range up through 1978, it has since declined as its habitat has been modified for land and water development (CDOW 1992). Populations were considered to be stable at moderate levels in 2005 (CDOW 2005). Population conservation efforts have consisted mainly of expanding common shiner distribution into protected habitats (CDOW 1992).

3.16.3.1.8 *Iowa Darter*

Iowa darter, a Colorado state species of concern, occurs from southern Canada south to New York

and west to Nebraska and Colorado. The Iowa darter was collected within the project area in low numbers from the Cache la Poudre River in 1994 (Nesler et al. 1997) and from the South Platte River in 2002 and 2003 (USGS 2003). This species prefers cool, clear streams with low to medium gradients, overhanging vegetation, and undercut banks. Iowa darter populations are considered to be secure through most of the northern part of their range, but populations are vulnerable in Colorado and several other states in the southern part of its range, likely due to habitat degradation from dewatering, channelization, pollution, and the introduction of nonnative species (NatureServe 2006; Woodling 1985). Iowa darter populations in Colorado were considered to be stable at moderate levels in 2005 (CDOW 2005).

3.16.3.1.9 *Two-Spotted Skipper*

The two-spotted skipper is widespread across the eastern United States and Canada. In Colorado, this species is known in Larimer, Boulder, and Weld counties (USGS 2006). This species is considered imperiled in Colorado (CNHP 2004) and occurs primarily in sedge (*Carex*) meadows. The larvae feed on sedges, although the primary host species is not known (NatureServe 2006). A known population of the two-spotted skipper occurs south of the Holcim Mine (CNHP 2004) and the two-spotted skipper has been observed at the City of Fort Collins Butterfly Woods Natural Area (Bachand, pers. comm. 2006).

3.16.3.1.10 *Smokey-Eyed Brown Butterfly*

The smokey-eyed brown butterfly is globally secure, but critically imperiled in Colorado. This species inhabits wetland areas surrounded by tallgrass prairie. The larvae feed on sedges, although it is not known which species are preferred (NatureServe 2006). The smokey-eyed brown butterfly has been recorded in the vicinity of the Glade Reservoir footprint (CNHP 2004), and has been observed at

the City of Fort Collins Butterfly Woods Natural Area (Bachand, pers. comm. 2006).

3.16.3.1.11 Bell's Twinpod

Bell's twinpod is found on dry, loose shales derived from Niobrara Shale (Spackman et al. 1997). The plant is often found at road cuts and along natural outcrops. Bell's twinpod is known from approximately 25 sites in northeast Colorado, with an estimated population of over a million individuals. However, it is considered globally and state imperiled because of threats from mining, suburban expansion, and road construction (NatureServe 2006).

3.16.3.1.12 American Currant

The American currant is found infrequently in moist woodlands and riparian areas at the base of the Rocky Mountains in Colorado. American currant is similar to other currants found in Colorado, except it has resinous dots on its leaves (Weber and Wittman 2001). The American currant has been observed in the City of Fort Collins Springer Natural Area (City of Fort Collins 2002).

3.16.4 Glade Reservoir Study Area

3.16.4.1 Federally Listed Threatened, Endangered, and Candidate Species

3.16.4.1.1 Black-footed Ferret

One small prairie dog town occurs on the northeastern side of the proposed Glade Reservoir footprint (Figure 3-16). The prairie dog colony in the Glade Reservoir study area is smaller than 80 acres, and thus unlikely to support ferrets.

3.16.4.1.2 Preble's Meadow Jumping Mouse

Potential Preble's habitat in the study areas is shown on Figure 3-16. Two adult Preble's were captured on August 10, 2004, immediately southwest of the Glade Reservoir study area along an unnamed tributary to the Cache la Poudre River (ERO 2004).

Additionally, Preble's are known to occur along portions of the Cache la Poudre River approximately 3 miles south of the Glade Reservoir study area.

3.16.4.1.3 Bald Eagle

An active bald eagle nest is located on the Poudre River on private land just south of the Glade Reservoir study area across from the City of Greeley's water filtration plant (Figure 3-16). In addition, bald eagle winter roost sites occur along the Cache la Poudre River south of the Glade Reservoir study area. Bald eagles from the nest or roost sites may occasionally forage in the Glade Reservoir study area.

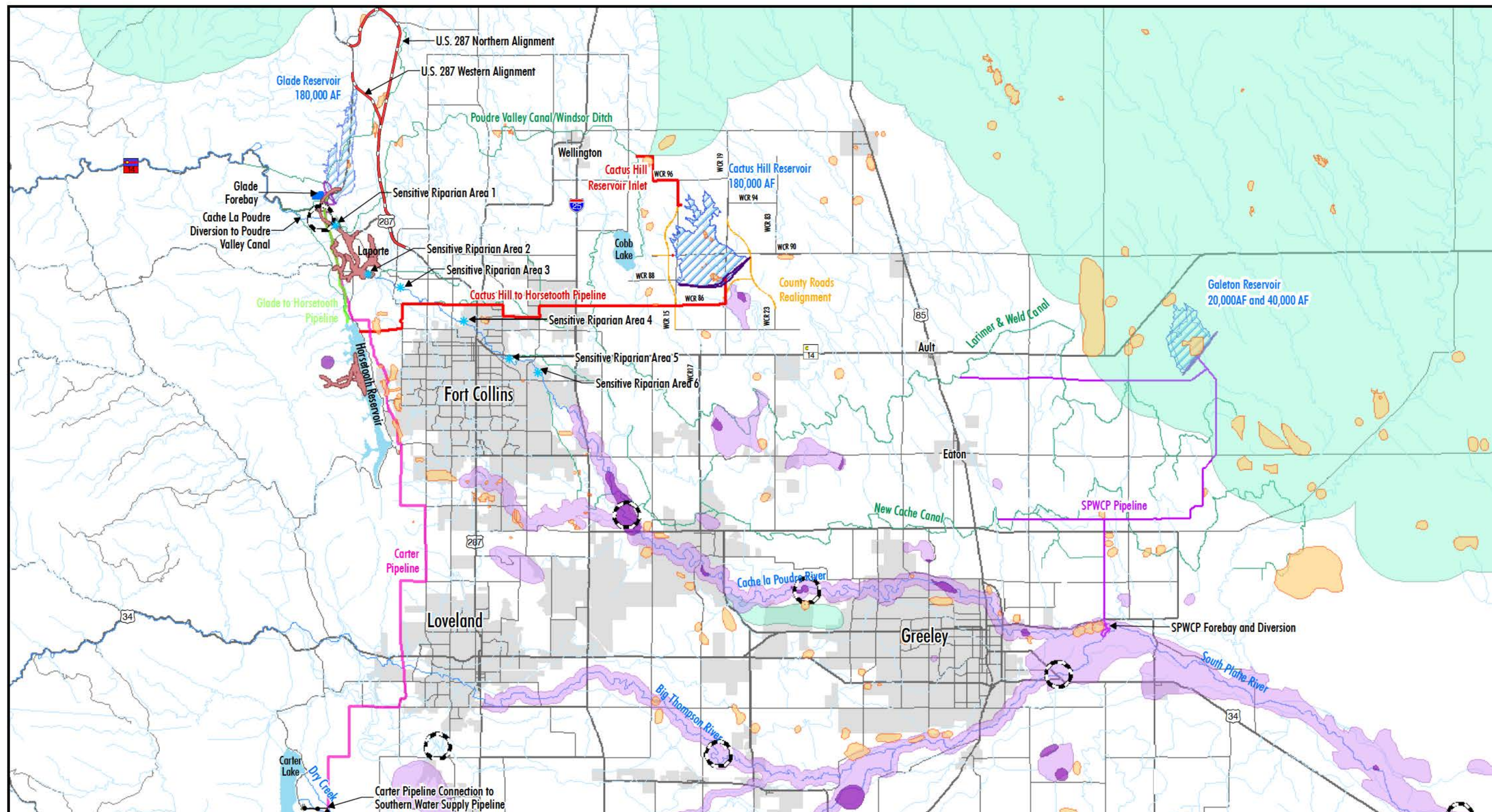
3.16.4.1.4 Colorado Butterfly Plant

CBP was not found during vegetation surveys of the Glade Reservoir and U.S. 287 realignment study areas (ERO 2008d). A CBP survey and habitat assessment report was submitted to the Service for the Glade study area. Although no CBP were found during surveys, the Service requested that all areas with suitable habitat be surveyed for 2 years before construction (Service 2007; Mayo 2007).

3.16.4.1.5 Ute Ladies'-tresses Orchid

Surveys for ULTO are not required at the Glade Reservoir study area because all of the drainages and swales in the study area are ephemeral or intermittent and do not provide suitable habitat for ULTO. However, no ULTO was found during vegetation surveys along the drainages within the Glade Reservoir study area (ERO 2008d).

A ULTO survey and habitat assessment report was submitted to the Service for the Glade Reservoir study area. Although no occurrence of ULTO was found during surveys, the ULTO has been found near Fort Collins. Therefore, the Service recommends all suitable habitat be surveyed for 2 years prior to construction (Service 2007; Mayo 2007).



Prepared by:
ERO

Northern Integrated Supply Project Species of Concern

- | | | |
|---------------------|--------------------------------------|--------------------|
| Proposed Reservoirs | Swift Fox Overall Range | Prairie Dog Colony |
| Existing Pipelines | PMJM Occupied Habitat | |
| Canals | Bald Eagle Active Nest Buffer | |
| Major Rivers | Bald Eagle Winter Concentration Area | |
| Minor Rivers | Bald Eagle Roost Site | |

Source: Swift fox overall range, bald eagle nest sites, and bald eagle winter concentration areas from CNDIS (2005). Prairie dog habitat based on CNDIS mapping and field verified by ERO for reservoir sites. Preble's habitat based on 2005 CNDIS occupied preble's habitat, the U.S. Fish and Wildlife Service's preble's trapping database, and results of trapping surveys conducted by ERO in 2004.

0 10,000 20,000 Feet
1 Inch = 20,000 Feet



Figure 3-16
Overview of Threatened & Endangered
Species Habitat in the Study Areas

Prepared for: U.S. Army Corps of Engineers
File: 2701 T&E_overview_Fig7.mxd(JP)
April 9, 2008

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3.16.4.2 State Species of Concern

One small prairie dog town occurs on the northeastern side of the Glade Reservoir study area. The extreme northern end of the Glade Reservoir study area is designated as swift fox overall range (CNDIS 2006). Marginal breeding habitat for peregrine falcon occurs in rocky outcrops and cliff areas located on the hogbacks in the study area. Two common gartersnakes were observed near an unnamed drainage, and leopard frogs were observed in wetland areas in the southern portion of the Glade Reservoir study area. One historical record (1890) of lavender hyssop occurs southwest of the Glade Reservoir study area near Rist Canyon (CNHP 2004). Potential habitat for this species may occur along the drainages of the Glade Reservoir study area, but none were observed during vegetation surveys. Potential habitat for the Rocky Mountain sedge exists within the riparian woodlands in the foothills on the western edge of the Glade Reservoir study area, although none were observed during vegetation surveys.

3.16.5 Galeton Reservoir Study Area

3.16.5.1 Federally Listed Threatened, Endangered, and Candidate Species

An approximately 240-acre prairie dog colony located within the proposed Galeton Reservoir footprint area is considered large enough to potentially support a population of black-footed ferret. Nocturnal ferret surveys of the Galeton Reservoir study area were conducted according to Service protocol (ERO 2005c). No ferrets or signs of ferrets were observed during the surveys.

3.16.5.2 State Species of Concern

As mentioned above, a large prairie dog colony is located in the Galeton Reservoir study area. Four

swift fox were observed during ferret surveys of the Galeton Reservoir study area conducted in September 2005. Prairie dog towns in the Galeton Reservoir study area also provide habitat for the burrowing owl, which was observed at the study area during field surveys conducted in July 2005. The Galeton Reservoir study area supports abundant prey species, and provides suitable breeding and foraging habitat for the ferruginous hawk. Although, no nesting has been observed at the Galeton Reservoir study area, known breeding populations of ferruginous hawk occur in nearby areas (Kingery 1998). The Galeton Reservoir study area also contains potential habitat for the long-billed curlew. This species is known to breed on the Pawnee National Grasslands north and east of the Galeton Reservoir study area (Nelson 1998).

3.16.6 Cactus Hill Reservoir Study Area

3.16.6.1 Federally Listed Threatened, Endangered, and Candidate Species

The bald eagle may occasionally forage in prairie dog colonies at the Cactus Hill Reservoir study area, although no perennial streams or large bodies of water, winter roost sites, or designated critical habitat occur at the site.

3.16.6.2 State Species of Concern

Several small (less than 80-acre) prairie dog colonies occur at the Cactus Hill Reservoir study area. The Cactus Hill Reservoir study area occurs within swift fox overall range and contains patches of suitable swift fox denning habitat. Prairie dog colonies in this study area provide habitat for the burrowing owl, which was observed at the study area during field surveys. The Cactus Hill Reservoir study area contains open grassland suitable for foraging and breeding ferruginous hawk, although no breeding

has been recorded in this portion of Weld County (Kingery 1998). The dry playa areas and areas of buffalograss at this study area provide suitable breeding habitat for the mountain plover, although much of the study area contains vegetation over 6 inches tall. The nearest occurrences of this species are in the Pawnee National Grasslands (CNHP 2004). The Cactus Hill Reservoir study area contains potential habitat for the long-billed curlew. The species is also known to breed on the Pawnee National Grasslands (Nelson 1998).

3.16.7 Species of Concern Common to Pipeline Study Areas

3.16.7.1 Federally Listed Threatened, Endangered, and Candidate Species

All of the proposed pipelines cross drainages with known or potential habitat for federally listed species. A CBP and ULTO survey and habitat assessment report was submitted to the Service for the Poudre River floodplain of the Glade to Horsetooth, Carter, and Cactus Hill to Horsetooth pipeline study areas, and the Carter pipeline crossing of the Big Thompson floodplain. Although the Service concurred that CBP and ULTO surveys would not be required in these areas, the Service recommends that all other areas where habitat disturbance is proposed be surveyed to identify potential habitat for ULTO and CBP (Service 2007). All pipeline areas with potential habitat should be surveyed for at least 2 years prior to construction (Mayo 2007). Known habitat for bald eagle and Preble's are more localized than the CBP and ULTO and are discussed individually in the following sections for each pipeline study area.

3.16.7.2 State Species of Concern

Because the pipeline and canal study areas are linear, they include habitat for many of the same

state species of concern, as previously described. Many of the pipeline and canal study areas include portions of small prairie dog colonies. These colonies are currently smaller than 80 acres, and thus unlikely to support the black-footed ferret, although they provide potential habitat for burrowing owl and mountain plover. The pipeline and canal study areas traverse swift fox overall range and suitable habitat. Western portions of the pipeline and canal study areas cross potential breeding and foraging habitat for ferruginous hawk and mountain plover. Wetland habitats in the pipeline alignments and along canals provide habitat for the common gartersnake and northern leopard frog.

3.16.8 SPWCP Pipeline Study Area

Wetlands and riparian areas in the SPWCP forebay and diversion study area are unlikely to support Preble's because they are dominated by weedy species, mostly disturbed, and lack the vertical vegetative structure preferred by Preble's. Stream banks are steep and in some places, deeply incised, or debris-filled and the surrounding area is heavily disturbed by human activity. In addition, numerous surveys within higher quality potential habitat in the Poudre River or South Platte River corridors indicate the area is not occupied by Preble's (Service 2005a). A Preble's habitat assessment report was submitted to the Service for the SPWCP forebay and diversion study area requesting concurrence that this area is not likely to support Preble's (ERO 2006b). The Service has concurred that this study area does not provide suitable habitat for Preble's (Service 2008).

3.16.9 Glade to Horsetooth Pipeline Study Area

3.16.9.1 *Preble's Meadow Jumping Mouse*

Potential Preble's habitat in the study areas is shown on Figure 3-16. According to the Service's Preble's occurrence database, Preble's are known to occur along portions of the Glade to Horsetooth pipeline study area.

3.16.9.2 *Bald Eagle*

An active bald eagle nest is located near the Glade to Horsetooth pipeline study area. The nest is located on the Poudre River on private land just south of the Glade Reservoir study area across from the City of Greeley's water filtration plant (Figure 3-16). Although the nest is not currently being monitored, it has been occupied since at least 2004. Young were fledged from this nest in 2005 (Bibles 2006).

3.16.10 Carter Pipeline Study Area

3.16.10.1 *Federally Listed Threatened, Endangered, and Candidate Species*

3.16.10.1.1 *Preble's Meadow Jumping Mouse*

Preble's are known to occur in the northern portion of the Carter pipeline study area (Service 2005b).

3.16.10.1.2 *Bald Eagle*

An active bald eagle nest is located near the northern portion of the Carter pipeline study area (see Section 3.16.9).

3.16.10.1.3 *Ute Ladies'-tresses Orchid*

A population of ULTO occurs within 1 mile of the Glade to Horsetooth pipeline study area. Although suitable ULTO habitat could occur in the Glade to Horsetooth pipeline study area, none were found at the proposed crossing of the Poudre River floodplain.

3.16.10.2 *State Species of Concern*

Potential Bell's twinpod habitat may occur in the Carter pipeline route on shale outcrops east and south of Horsetooth Reservoir. Surveys for this species should be conducted in the appropriate season prior to construction.

3.16.11 Poudre-South Platte River Corridor Study Area

3.16.11.1 *Federally Listed Threatened, Endangered, and Candidate Species*

3.16.11.1.1 *Preble's Meadow Jumping Mouse*

Known occupied Preble's habitat in the study areas is shown on Figure 3-16. Preble's is not known to occur on the Cache la Poudre River downstream of Fort Collins or on the South Platte River downstream of its confluence with the Poudre River.

3.16.11.1.2 *Bald Eagle*

Three active bald eagle nests are located along the Poudre River in the Poudre-South Platte River corridor study area. Several bald eagle roost sites occur in this study area downstream of Fort Collins (Figure 3-16).

3.16.11.1.3 *Colorado Butterfly Plant*

Potential habitat for CBP may occur within the active floodplain of the Cache la Poudre and South Platte rivers. However, no populations of the CBP are known in these corridors.

3.16.11.1.4 *Ute Ladies'-tresses Orchid*

Potential habitat for ULTO may occur within the wetlands and riparian areas in the Poudre-South Platte River corridor study area. However, no populations of the ULTO are known in these corridors.

3.16.11.2 State Species of Concern

Wetland and riparian habitats occurring in the Poudre-South Platte River corridor study area potentially support the common gartersnake, northern leopard frog, two-spotted skipper, smokey-eyed brown butterfly, and American currant. However, much of the study area occurs in urban areas, diminishing the value of these areas for wildlife. The brassy minnow, common shiner, and Iowa darter have been recorded within the Poudre-South Platte River corridor study area. The brassy minnow and common shiner were last observed in the study area in 1992 (Bestgen and Fausch 1993), and the Iowa darter was last observed in the study area in 2003. These fish species of concern were not observed during the 2005 supplemental fish sampling, and are further discussed in Section 3.15.4.

3.16.12 Agricultural Transfer Lands Study Area

3.16.12.1 Federally Listed Threatened, Endangered, and Candidate Species

No potential habitat for federally listed species occurs in the Agricultural Transfer Lands study area.

3.16.12.2 State Species of Concern

The Agricultural Transfer Lands study area occurs within swift fox overall range and contains patches of suitable den habitat for this species. These open grassland areas are also suitable foraging and breeding habitat for ferruginous hawk, although no breeding has been recorded in this portion of Weld County (Kingery 1998). Isolated patches of prairie dog colonies provide habitat for the burrowing owl and mountain plover, which also may occur in grazed pasturelands.

Wetlands supported by irrigation provide potential habitat for the common gartersnake and northern leopard frog. However, wetlands in the Agricultural Transfer Lands study area generally provide low quality habitat because they are frequently subject to disturbance.

3.16.13 No Action Study Areas

The No Action study areas include open water, wetlands, and riparian habitat associated with gravel lakes, depressions that form temporarily during gravel mining; and portions of the South Platte River, Cache la Poudre River, St. Vrain Creek, Boulder Creek, and Big Thompson River corridors. Since the No Action study areas are generally disturbed and/or include urban areas, riverine species adapted to disturbance from human activity are most likely to occur in these study areas. In addition, the No Action study areas include agricultural lands from which water would be transferred.

There are a number of possible gravel pit locations that could be used under the No Action alternative (Figure 1-1), and it is not known which would be the most likely; therefore, the study areas for threatened, endangered, candidate, and other species of concern are unknown. It is possible that threatened, endangered, candidate, and other species of concern occur in agricultural areas that could be affected by the No Action alternative.

3.16.13.1 Federally Listed Threatened, Endangered, and Candidate Species

3.16.13.1.1 Preble's Meadow Jumping Mouse

Potential Preble's habitat could occur in wetlands and riparian areas in the general vicinity of the proposed gravel pit storage lakes, especially those located near occupied Preble's habitat near the confluences of the Big Thompson and Little

Thompson rivers and the Big Thompson and South Platte rivers.

3.16.13.1.2 Bald Eagle

All of the proposed gravel lakes storage site areas are within bald eagle winter concentration areas, and several are in the vicinity of roost sites or active nest sites (Figure 1-1).

3.16.13.1.3 Colorado Butterfly Plant

Potential habitat for CBP may occur within portions of the active floodplain of the South Platte River, Cache la Poudre River, St. Vrain Creek, Boulder Creek, and Big Thompson River within the No Action study areas.

3.16.13.1.4 Ute Ladies'-tresses Orchid

Potential habitat for ULTO may occur within the wetlands and riparian areas associated with portions of the South Platte River, Cache la Poudre River, St. Vrain Creek, Boulder Creek, and Big Thompson River in the No Action study areas.

3.16.13.2 State Species of Concern

Wetland and riparian habitats occurring in the Participant No Action study areas potentially support the common gartersnake and northern leopard frog. However, much of the study area occurs in urban areas, diminishing the wildlife value of these areas.

3.17 RECREATION

This section presents a summary of the existing recreation resources in the study areas. Recreational resources in the study areas could be affected by project-related changes in streamflows and/or reservoir levels. More detailed information on recreation is presented in the Recreation Resources Technical Report (ERO 2008e).

3.17.1 Horsetooth Reservoir

Located in the foothills at an elevation of 5,430 feet, Horsetooth Reservoir provides numerous year-round water- and land-based recreation opportunities including boating, fishing, camping, hiking, and mountain biking.

With a 25-mile shoreline, the total surface area available for recreation at Horsetooth Reservoir normally averages about 2,000 acres during prime recreation months (June, July, and August) (Reclamation 2006). According to visitor surveys conducted by Larimer County, 539,929 people visited Horsetooth Reservoir in 2005 (Larimer County Planning Department 2005). Use of the reservoir varies during the year, with the greatest activity occurring on the weekends and holidays from late May to early September (Coffman, pers. comm. 2006).

Horsetooth Reservoir is part of the C-BT Project operated by Reclamation and the District, and water levels are managed jointly by the two agencies. Recreation at Horsetooth Reservoir is managed by the Larimer County Parks and Open Lands Department (LCPD). Recreation developments include four campgrounds, 111 campsites, five boat-launch ramps, a public marina, and a developed public swim beach (Larimer County 2006a).

Horsetooth Reservoir generally fills during the winter and spring. Drawdown generally begins in June and continues through October. Under normal conditions, reservoir levels fluctuate up to 60 feet every year (Larimer County 2006a). As a result, some areas near the edge of the shoreline at high water become more than 0.5 mile from the shoreline by the end of the summer (Coffman 2006). The effect of the drawdown is most dramatic at South Bay and some of the coves along the western side of Horsetooth Reservoir (Coffman 2006). The

elevation of the reservoir is 5,430 feet at full capacity. Approximate minimum elevations required for use of the five boat ramps and swim beach are as follows (Boaz, pers. comm. 2006):

- South Bay South 5,393 feet
- Satanka 5,385 feet
- Inlet Bay South 5,370 feet
- Inlet Bay Marina 5,364 feet
- South Bay North 5,355 feet
- Swim Beach 5,333 feet

3.17.1.1 Boating

Motorized boating is the primary recreation activity at Horsetooth Reservoir (Coffman 2006). Boaters access the reservoir from three locations: Inlet Bay, South Bay, and Satanka Cove. Approximately 123 acres of the reservoir are restricted to wakeless boating or are off limits to motorized boat traffic. These areas include the congested areas near boat ramps and docks; the swim beach; areas where boats are in slips or moorings; and narrow, high-traffic areas like the neck of Inlet Bay. Other popular boating activities include pleasure boating, sailing, water skiing, jet skiing, and canoeing/kayaking. Larimer County Parks' staff estimate that the reservoir reaches boating capacity several times during the summer based on a current carrying capacity of 90 to 380 boats, depending upon the water surface available for boating (Coffman 2006).

3.17.1.2 Angling

Fishing is allowed year-round from shore or boat, and primary sport fish species include rainbow trout, crappie, smallmouth bass, white bass, largemouth bass, and walleye (Kehmeier, pers. comm. 2006; Larimer County 2006a).

3.17.1.3 Other Reservoir Recreation

Other popular water-based recreation activities include wind surfing, SCUBA, and swimming.

Land-based recreation at the reservoir includes camping, picnicking, hiking, and rock climbing. Camping is available at the South Bay Campground and Inlet Bay Campground, which are located along the south and southwestern edges of Horsetooth Reservoir, respectively. Seven cabins are available for rent on the western side of the South Bay. The sandstone cliffs around and adjacent to Horsetooth Reservoir have become popular rock climbing areas in recent years. Hiking trails at the reservoir are linked to trail systems in the adjacent Soderberg Open Space and Horsetooth Mountain Park.

3.17.2 Carter Lake

Carter Lake is leased by Reclamation to the Larimer County Parks and Open Lands Department who manages the area for public recreation use. Recreation amenities at the 910-acre Carter Lake Reservoir Recreation Site include campgrounds, a marina, three boat ramps, and about 4 miles of trails. Shoreline recreation activities are limited to developed sites rather than dispersed locations. Larimer County estimates the total number of day users during peak season weekends (May through September) to be approximately 2,200 (Fleming, pers. comm. 2003).

3.17.2.1 Boating

Two of the campgrounds, South Shore and North Pines, have boat launches. There is an additional boat ramp at the marina on the northeastern edge of the reservoir. Boat-related recreation includes pleasure boating, water skiing, jet skiing, sailing, and canoeing/kayaking. The marina has restaurant service, fishing and picnic supplies, firewood, boat mooring, gasoline, and boat rentals. Carter Lake Sailing Club (a private boating club) is located west of the North Pines Campground. The sailing club has a long-term lease with the Larimer County

Recreation Board and Reclamation, which allows the club to maintain facilities, including boat slips, on Carter Lake. The sailing club conducts races and an annual regatta during the sailing season, which is usually April through September (Carter Lake Sailing Club 2006). Larimer County estimates average peak season weekend use to be 140 boats at low reservoir levels and 190 boats when the reservoir is full. Based on historical water levels, the reservoir elevation ranges between 5,707 feet and 5,753 feet during the May to September recreation season. Approximate minimum elevations required for use of the three boat ramps are as follows (Boaz, pers. comm. 2006):

- South 5,695 feet
- North 5,665 feet
- North Pines 5,675 feet

3.17.2.2 Angling

Fishing is allowed year-round from shore or boat, and species in the lake include rainbow trout, Snake River cutthroat, splake (a cross between speckled, or brown, and lake trout), brown trout, walleye, yellow perch, kokanee salmon, and largemouth bass (Larimer County 2006b).

3.17.2.3 Other Reservoir Recreation

Other popular water-based recreation activities include wind surfing, SCUBA, and swimming. Land-based recreation at the reservoir includes camping, picnicking, hiking, horseback riding, and rock climbing. Surrounding the lake are two hiking trails with a total trail length of about 4 miles. The Fawn Hollow trail, approximately 1 mile in length, is accessed from the north at the Dam One trailhead, and from the south at the Saddle trailhead. The Shoreline trail runs nearly the length of the east lakeshore and is 3 miles long. The Shoreline trail is accessed from the north near the North Pines Campground, and from the south at the South Shore

Campground. Portions of the Shoreline trail are accessible by wheelchair (Larimer County 2006b). Other recreation amenities include a volleyball court and horseshoe pits at South Shore, a swim beach on the east shore near Dam Two, and a playground at the Eagle Campground. The Bison Visitor Center is located about 0.5 mile north of Carter Lake, and houses the Larimer County Parks and Open Lands Office.

3.17.3 River Corridors

The Cache la Poudre River corridor from the Munroe Canal diversion to its confluence with the South Platte River offers a variety of recreational opportunities (Figure 3-17 and Figure 3-18). Popular activities along the Poudre River corridor include biking, hiking, fishing, and, to a lesser extent, whitewater boating and tubing. The City of Fort Collins may further develop recreational opportunities associated with the Poudre River. As part of the Downtown River Corridor Implementation Program (City of Fort Collins 2000), the City of Fort Collins has proposed a Recreational River Channel Enhancements Feasibility Study. The feasibility study would evaluate the development of recreational opportunities including boating, fishing, and other uses of the Poudre River within Fort Collins. In addition, a nonprofit organization, Friends of the Poudre, has proposed the development of a water craft course along the Poudre River in the vicinity of College Avenue in Fort Collins (Friends of the Poudre 2006).

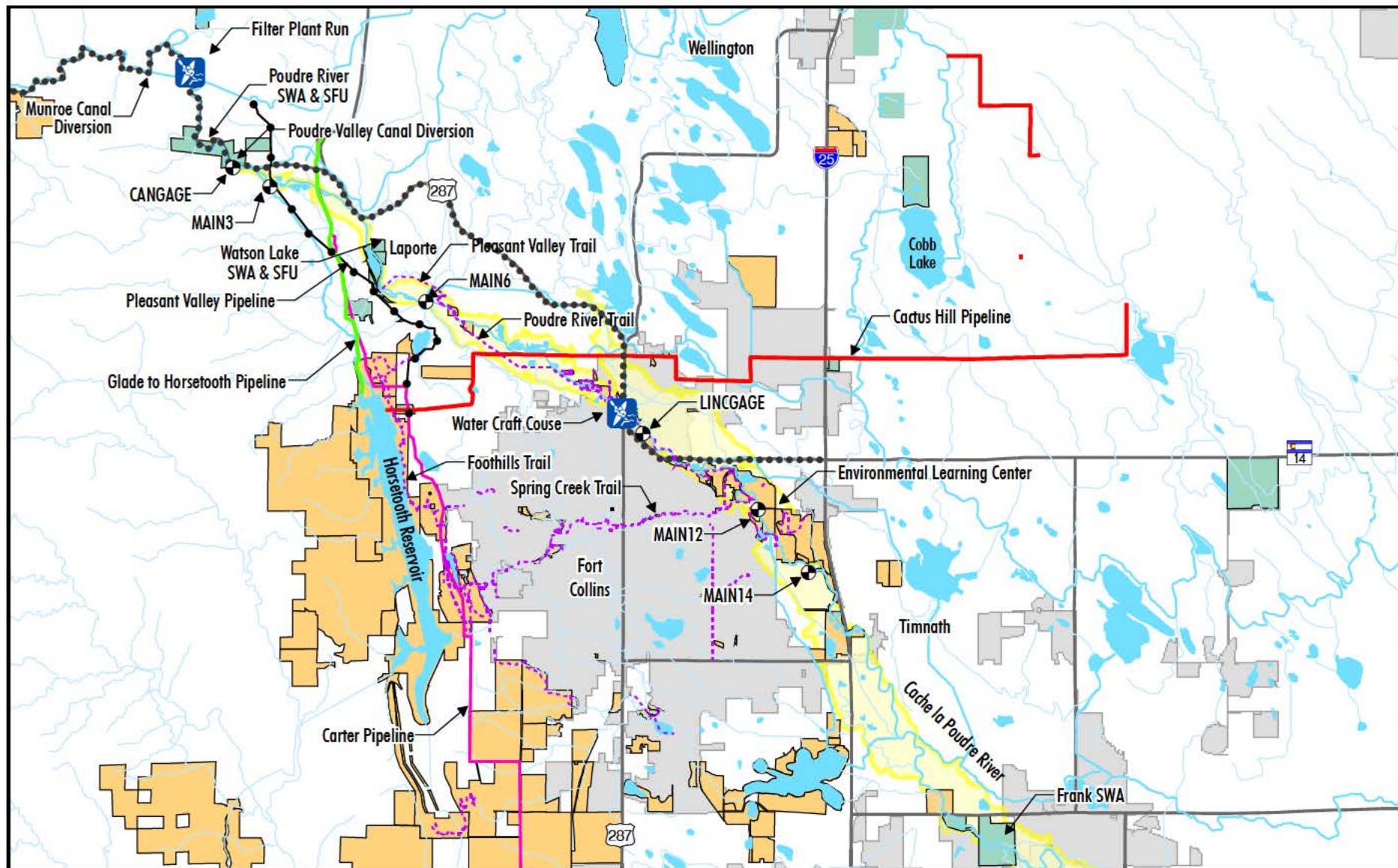


Figure 3-17
Recreation in the Cache La Poudre
River Corridor (North)

Prepared for: U.S. Army Corps of Engineers
File: 2701-poudre_rec_North.mxd (JP)
October 17, 2006



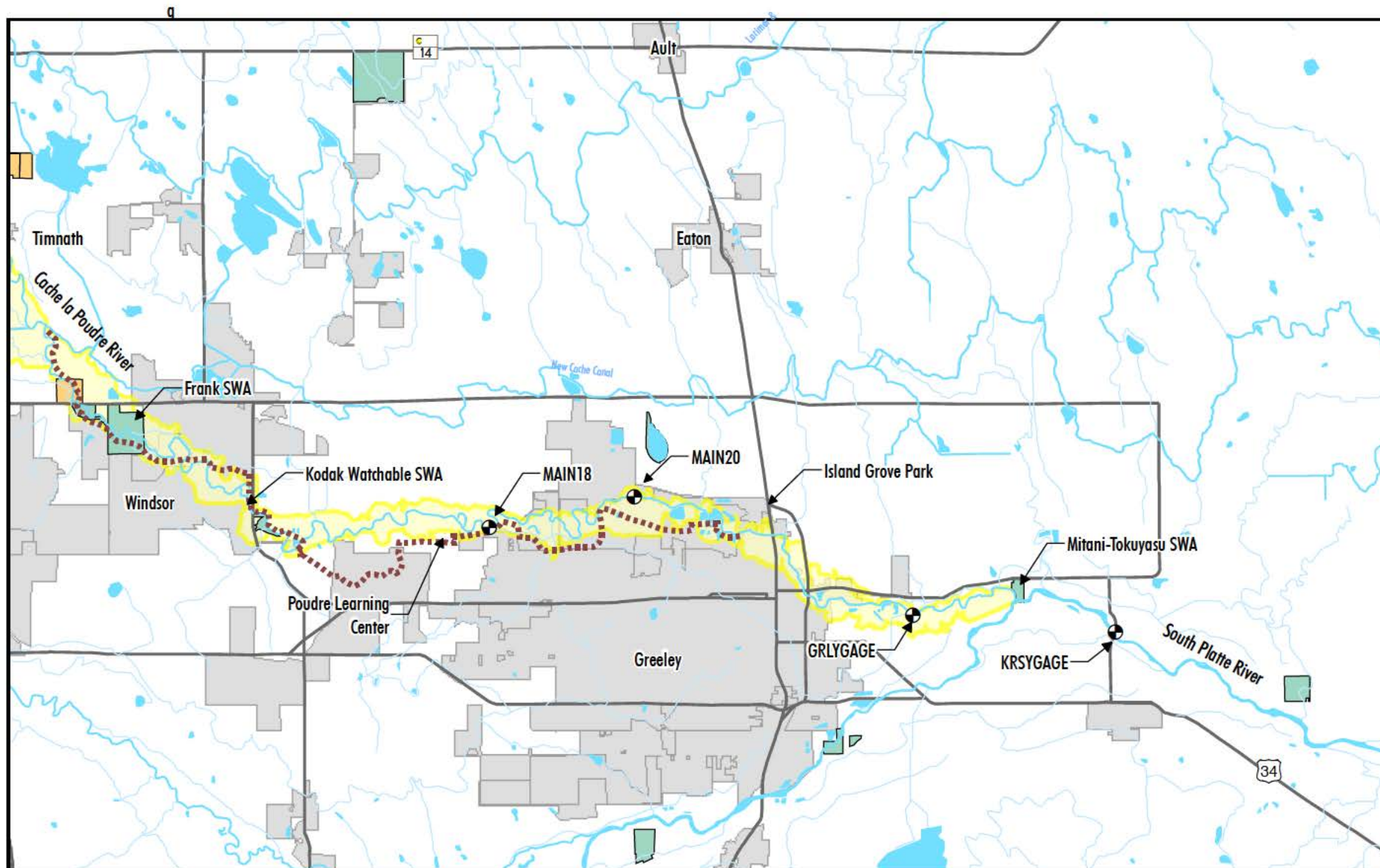
Prepared by:
ERO

- Cache La Poudre Corridor
- State Wildlife Area (SWA)
- Natural Area
- Trails
- Cache La Poudre/ North Park Scenic Byway
- Major Rivers
- Canals
- Streams
- Stream Gage or MODSIM Node Location

Source: State Wildlife Areas provided by CDOW, 2005. Poudre River Corridor provided by National Parks Service, 2006. Natural Areas provided by the City of Fort Collins, 2005.

0 7,500 15,000
Feet
1 inch = 15,000 Feet





Prepared by:
ERO

- Cache La Poudre Corridor
- State Wildlife Area (SWA)
- Natural Area

- Cache La Poudre Trail (approximate location)

- Cache La Poudre/ North Park Scenic Byway
- Major Rivers
- Canals
- Streams
- Stream Gauge or MODSIM Node Location

Source: State Wildlife Areas provided by CDOW, 2005. Poudre River Corridor provided by National Parks Service, 2006. Natural Areas provided by the City of Fort Collins, 2005.

0 7,500 15,000
Feet
1 inch = 15,000 Feet



Figure 3-18
Recreation in the Cache La Poudre
River Corridor (South)

Prepared for: U.S. Army Corps of Engineers
File: 2701-poudre_rec_South.mxd (JP)
October 17, 2007

Opportunities for water-based recreation along the small segment of the South Platte River in the study area is more limited compared to the Poudre River due to reduced water quality associated with runoff and treated effluent discharges from neighboring towns and cities and the lack of developed trails and parks.

3.17.3.1 Boating

Whitewater recreation such as rafting and kayaking is extremely popular in the Poudre River upstream of the Poudre Valley Canal diversion. The Filter Plant Run is a Class II to III river run that is within the NISP study area (between the Munroe Canal diversion and the Poudre Valley Canal diversion), and attracts a moderate amount of commercial and private rafters and kayakers during the summer months. Picnic Rock, located at the lower end of the Filter Plant Run, is popular for tubing. The river reach downstream of the mouth of Poudre Canyon receives limited use by kayakers and canoers. However, local boaters, such as the Poudre Paddlers Club, occasionally paddle the Poudre River in the City of Fort Collins between Shields and Prospect streets, which is also popular for tubing. The Poudre River Boat Chute was opened in June 2000 and was designed to channel the river's flow into an aesthetically pleasing structure that facilitates boat passage (City of Fort Collins 2006). Located near the old Fort Collins power plant just east of the North College Bridge, the boat chute provides a navigable passage for paddlers. In 1992, the City of Fort Collins received a water right to use the Poudre River flows for recreational purposes (*City of Thornton v. City of Fort Collins*, 830 Colo. 1992). The City of Fort Collins currently has the right to 31.5 cubic feet per second (cfs) during May through August for the boat chute and another dam structure located near the Environmental Learning Center

designed to divert the Poudre River back to its historical channel (Bode 2006).

3.17.3.2 Angling

Although some anglers fish the Poudre River from the Poudre Valley Canal diversion to its confluence with the South Platte River, fishing in this reach is substantially less popular than upstream in the Poudre Canyon. The section of the Poudre River from the Poudre Valley Canal diversion to Lee Martinez Park in Fort Collins receives moderate fishing pressure for brief periods during early spring and late fall. Wild spawn, coldwater species favored by sport fisherman such as brown and rainbow trout occur in this section, which is not stocked. The Watson Lake State Fishing Unit and the Lions Park trailhead provide access for coldwater stream fishing in the study area upstream of Fort Collins. CDOW manages the Poudre River from Fort Collins downstream to the confluence with the South Platte River for native nongame fish species. The Poudre River in this section is stocked with "catchable" rainbow trout, intended to provide instant recreational opportunities. Most of the ponds on public lands along the Poudre are stocked with warmwater species, and receive an estimated 1,000 to 1,500 hours/acre of fishing use annually. The Platte River from Greeley to Fort Morgan is managed for native warmwater species habitat rather than recreational fishing, and is not stocked (Kehmeier, pers. comm. 2005).

3.17.3.3 Scenic Driving

Highway 14, which follows much of the Poudre River, is a Scenic Byway between the communities of Fort Collins and Walden. The Cache la Poudre-North Park Scenic Byway is recognized as one of Colorado's premier scenic highways, although its most spectacular portions occur west of the study area.

3.17.3.4 Nature Study and Observation

Numerous opportunities for watching the abundant wildlife associated with the Poudre River corridor are available in the study area. Several State Wildlife Areas (SWAs) have been designated along the Poudre River including, from upstream to downstream, the Watson Lake, Frank, Kodak, Mitani-Tokuyasu, and Centennial Valley SWAs. SWAs are managed by the CDOW to maintain and enhance wildlife populations and habitat and to provide wildlife-related recreation. In addition, numerous natural areas, designated by Fort Collins to provide day-use observation areas for nature-oriented recreation, are located along the Poudre River. The proposed Galeton forebay and a portion of the SPWCP pipeline occur within the Mitani-Tokuyasu SWA.

The Environmental Learning Center is located along the Poudre River in Fort Collins and provides opportunities for environmental education during the summer months. The Poudre Learning Center, located just northwest of Greeley near the Cache la Poudre River, was recently constructed to support a wide variety of educational opportunities.

3.17.3.5 Walking and Biking

A nearly continuous trail follows the Poudre River from just east of Fort Collins to Greeley. This developing regional trail corridor currently offers nonmotorized recreational opportunities including biking, walking, running, and rollerblading. The Pleasant Valley trail begins at the Watson Lake SWA and follows the Poudre River to Lions Park, where it connects with the Poudre River trail, which continues through Fort Collins, downstream to the Environmental Learning Center. Expansion of this trail is expected over the next several years. The Poudre River trail from Island Grove Regional Park in Greeley to the Weld/Larimer County line along

the Cache la Poudre River is currently under construction. Approximately 10 miles of this 19-mile trail have been completed. Timnath has proposed development of trails that would connect the eastern and western portions (Town of Timnath 2005).

3.17.3.6 Other Recreation

Several municipal parks located adjacent to the Poudre River provide family recreation opportunities including Lee Martinez Park in Fort Collins, Eastman Park in Windsor, and Island Grove Park in Greeley. The Kodak Watchable Wildlife Area provides wildlife viewing opportunities near Windsor. In addition, the Frank, Centennial Valley, and Mitani-Tokuyasu SWAs are open to hunting and fishing (Figure 3-18).

3.17.4 Proposed Reservoirs

3.17.4.1 Glade Reservoir

Most of the proposed Glade Reservoir is owned by the District and is not open for public use. The southwestern corner of the Glade Reservoir study area, known as the Poudre River State Trust Land Parcel, is owned by the State Land Board and leased by the CDOW to allow public access for fishing year-round and hunting during specified times of the year. The Bureau of Land Management (BLM) also owns a very small area on the western side of Glade Reservoir that is not open for recreational public access.

3.17.4.2 Galeton Reservoir

Except for about 36.4 acres of State Land Board land, the entire proposed Galeton Reservoir at 40,000 AF is privately owned and is not open to public use.

3.17.4.3 Cactus Hill Reservoir

Almost the entire Cactus Hill Reservoir is owned by Anheuser-Busch and is not open for public use. It is used for disposal of wastewater associated with beer production. Some areas of the Cactus Hill Reservoir site are privately owned by other landowners, and are used for agricultural purposes such as crop production and cattle grazing. No public recreational uses currently occur on the proposed site.

3.18 CULTURAL RESOURCES

This section presents a summary of known cultural resources in the study areas. Cultural resources in the study areas could be affected by reservoir and facility construction activities. More detailed information on cultural resources within the study areas is presented in the Cultural Resources Technical Report (WCRM 2007).

3.18.1 Regulatory Framework

Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA, 16 U.S.C. 470, et seq.) requires all federal agencies to consider effects of any federal action on cultural resources eligible for or listed in the National Register of Historic Places (NRHP) prior to initiating such actions. In addition, NEPA requires federal agencies to consider the impacts of their activities on cultural resources when examining the impacts of a project on the environment.

This NEPA process will be used by the Corps to satisfy its Section 106 compliance requirements. An agency may substitute the NEPA process in lieu of Section 106 of the NHPA. The Corps has notified the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation that

the Corps intends to substitute NEPA for Section 106; the Corps has identified and contacted consulting parties, especially Native American Tribes; and identified historic properties and assessed effects in a manner consistent with Section 106. The scope and timing of identification and assessment may be phased to reflect the consideration of project alternatives (Sec. 800.8(c)(1)(ii)). A Programmatic Agreement (PA) has been developed to address cultural resources (Appendix C).

Traditional Cultural Properties (TCPs) are protected under Section 106 of the NHPA; the American Indian Religious Freedom Act of 1978; and the Native American Grave Protection and Repatriation Act of 1990. A TCP may be eligible for listing in the NRHP because of its association with cultural practices or beliefs of a living community that: a) are rooted in the history of the community or tribe; and, b) are important in maintaining the continuing cultural identity of the community or tribe.

3.18.2 Coordination with Native American Tribes

The Corps contacted 47 Native American tribes to request information on whether TCPs are located within the area of potential effect (Table 3-25).

Table 3-25. Coordination with Native American Tribes.

Native American Tribe	Coordination Status
Assiniboine and Sioux Tribes of Fort Peck	Continuing Coordination
Chippewa Cree Tribe of the Rocky Boys' Reservation	Continuing Coordination
Crow Nation	No Further Coordination
Gros Ventre and Assiniboine Tribe of Fort Belknap	Continuing Coordination
Lower Brule Sioux Tribe	Continuing Coordination
Oglala Sioux Tribe	Continuing Coordination
Prairie Band of Potawatomi Nation	Continuing Coordination
Santee Sioux Nation	Continuing Coordination
Standing Rock Sioux Tribe	Continuing Coordination
Winnebago Tribe of Nebraska	No Further Coordination
Apache Tribe of Oklahoma	Continuing Coordination
Comanche Tribe of Oklahoma	Continuing Coordination
Jicarilla Apache Tribe	Continuing Coordination
Otoe-Missouri Tribal Council	Continuing Coordination
Ute Mountain Ute Tribe	Continuing Coordination
Blackfeet Tribe	Continuing Coordination
Confederated Salish and Kootenai Tribes	Continuing Coordination
Eastern Shoshone Tribe	Continuing Coordination
Iowa Tribe of Kansas and Nebraska	No Further Coordination
Northern Arapaho Tribe	Continuing Coordination
Omaha Tribe of Nebraska	Continuing Coordination
Rosebud Sioux Tribe	Continuing Coordination
Sisseton-Wahpeton Sioux Tribe	Continuing Coordination
Three Affiliated Tribes	Continuing Coordination
Yankton Sioux Tribe	Continuing Coordination
Cheyenne-Arapaho Tribes of Oklahoma	Continuing Coordination
Fort Sill Apache	No Further Coordination
Kiowa Indian Tribe of Oklahoma	No Response
Pawnee Nation of Oklahoma	Continuing Coordination
Sac and Fox Tribe of the Mississippi in Iowa	No Further Coordination
Cheyenne River Sioux Tribe	Continuing Coordination
Crow Creek Sioux Tribe	No Further Coordination
Flandreau Santee Sioux Tribe	Continuing Coordination
Kickapoo Tribe in Kansas	Continuing Coordination
Northern Cheyenne Tribal Council	Continuing Coordination
Ponca Tribe of Nebraska	Continuing Coordination
Sac and Fox Nation of Missouri in Kansas and Nebraska	No Further Coordination
Spirit Lake Sioux Tribe	No Further Coordination
Turtle Mountain Band of Chippewa	No Further Coordination
Mni Sose Intertribal Water Rights Coalition	No Further Coordination
Comanche Nation	Continuing Coordination
Iowa Tribe of Oklahoma	Continuing Coordination
Northern Ute Tribe, Uintah and Ouray	Continuing Coordination
Ponca Tribe of Oklahoma	Continuing Coordination
Southern Ute Indian Tribe	No Further Coordination
Trenton Indian Service Area	Continuing Coordination
Sac and Fox Nation	Continuing Coordination

3.18.3 Area of Potential Effect

The NHPA and 36 CFR Part 800 requires the Corps to consider effects to historic properties within the area of potential effect (APE). The Corps ensures compliance with the requirements of NHPA by following 33 CFR Part 325, Appendix C. The APE is defined as “the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist (36 CFR Part 800.16).” The APE for each of the three potential new reservoir sites at Glade, Galeton, and Cactus Hill comprises areas that would be affected by reservoir construction, including the footprint, pipelines, access roads, rerouted transmission lines, staging areas, borrow areas, and other facilities. The APE includes a 1-mile buffer around each proposed reservoir, the proposed abandoned route of U.S. 287 and both of the proposed reroutes. The SHPO has concurred with the agency’s proposed APE.

3.18.4 Evaluation of Cultural Resource Significance

Potential historic properties may include districts, sites, buildings, structures, and objects that possess historical integrity and are more than 50 years old. Cultural resource types found within the APE for all reservoir locations include prehistoric archaeological sites and historic buildings, structures, and features, and isolated finds. Examples of prehistoric archaeological sites include camps where short-term occupation took place by hunter-gatherers, lithic scatters that represent the remains of temporary work areas, and hunting sites and blinds. Historic period cultural resources include ranches and homesteads, water diversion features, roads and trails, a cement plant, and U.S. 287.

Each cultural resource identified within the APE was evaluated for its potential to be listed in the NRHP. Evaluation of cultural resources is codified under 36 CFR 60.4, and summarized below (National Register Bulletin, revised 1998):

The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
- b) that are associated with the lives of persons significant in the past; or
- c) that embody the distinctive characteristics of a type, period, or method of construction, or that represents the work of a master, or that possess high artistic value, or that represent a significant or distinguishable entity whose components may lack individual distinction; or
- d) that have yielded, or are likely to yield, information important in prehistory or history.

Under the criteria set forth under 36 CFR 60.4, a cultural resource may be evaluated as “needs data” (or unevaluated), “eligible,” or “not eligible” for nomination to the NRHP. In some cases (needs data listings), additional information must be gathered to evaluate a cultural resource with regard to the NRHP criteria. Additional information may be gathered in the form of limited excavation and/or testing to determine the presence of significant buried cultural material or, in the case of historic sites, archival research to better evaluate these sites under criteria a-c, summarized above. Cultural resource sites recommended not eligible for the NRHP either do

not meet any of the criteria outlined under 36 CFR 60.4 or lack physical integrity (i.e., have been significantly altered or destroyed by previous human activity or natural processes).

Prior to consultation with the SHPO, cultural resources with field recommendations referred to as “needs data,” and those that have not been assessed, are considered potentially eligible for inclusion in the NRHP. For purposes of both the EIS process and the Section 106 process, consultation must occur between the Corps and the Colorado SHPO. The SHPO often recommends that sites should be re-recorded and re-evaluated when the previous recording occurred 5 or more years in the past, although the need to re-record a cultural resource site should be evaluated on a case-by-case basis. All cultural resource sites with “field” recommendations must be reviewed by the Corps and the SHPO and concurrence provided. If SHPO does not concur with the field recommendations provided by the Corps, continued consultation must occur. After consultation, the SHPO then formally concurs with the agency by providing a determination of eligibility (DOE) for each cultural resource within the APE. Some of the cultural resources identified within the potential alternatives already have a DOE from the SHPO. Cultural resources that are officially eligible for or listed in the NRHP, and that cannot be avoided during project implementation or operation would be adversely affected. Those sites, if present within the selected alternative, would be subject to mitigation measures agreed upon by the Corps and SHPO through consultation and under the terms of the PA (Appendix C).

For purposes of the EIS, only those cultural resources listed in or eligible (official determination and field recommendation) for the NRHP are listed below under each alternative feature. Cultural resources listed as field not eligible, not assessed, or

listed as needs data will be evaluated for eligibility under the Section 106 process.

3.18.5 Cultural History Overview

Summarizing the culture history of the combined APE (Glade, Galeton, Cactus Hill, U.S. 287 realignment, and all pipelines) requires an evaluation of human history along the Front Range of the southern Rocky Mountains and the eastern plains of Colorado. A succinct summary of this history is provided below, subdivided into chronologically sequential stages defined primarily by changes in subsistence strategies and material culture, both of which were strongly affected by environmental changes that occurred in the past. These stages are Paleoindian, Archaic, Late Prehistoric, and Historic. The cultural overview provided below is taken entirely from the synthetic overviews published by the Colorado Council of Professional Archaeologists (Gilmore et al. 1999; Church et al. 2007).

The Paleoindian stage is further subdivided into three periods: Clovis, Folsom, and Plano. Each of these periods is characterized by highly stylized projectile points—a reflection on the emphasis these people placed on hunting now-extinct mammoth and bison and later modern but smaller species of bison. Sites common to the periods include camps and kill sites. Archaeological sites of this general period are relatively rare, but some of the better known sites are found in northeast Colorado.

The Archaic stage is subdivided into Early, Middle, and Late period designations, based partially on changes in projectile point form and changes in settlement and subsistence strategies. Changes in climate forced humans to change their subsistence strategies toward generalized hunting and gathering where both plants and animals were an equally important food source. It is during this stage that hunter-gatherers likely began to form into bands

reminiscent of those tribes encountered during the 19th century. Common sites include camps, hunting sites, and limited-activity lithic scatters.

The Late Prehistoric stage again comprises three periods: Early Ceramic, Middle Ceramic, and Protohistoric. The Early Ceramic period was witness to the adoption of ceramic technology and the bow and arrow. Horticulture was practiced in the Denver Basin during the Early Ceramic period. A change in climate initiated the transition to the Middle Ceramic period, when much of the Front Range may have been abandoned due to drought forcing an emigration to the mountains. During this period the Numic people (modern Ute and Shoshone) occupied much of western Colorado to the Front Range and Athapaskan people (modern Navajo and Apache) probably used the Front Range as a travel corridor on their way to the Southwest. The Protohistoric sub-period begins in A.D. 1540 with the arrival of the Spanish in the Southwest; however, it took nearly 200 years for Euroamerican goods, including horses, to affect a change in Native American culture.

The advent of the horse radically changed the disposition of Native American tribes, turning semi-nomadic hunter-gatherers into highly nomadic, horse-mounted cultures. A succession of tribes occupied the Denver Basin and Front Range, including the Apache, Comanche, Kiowa, Cheyenne, and Arapaho. The Ute arrived in the Southern Rocky Mountains by at least A.D. 1400, but made only excursions into the Plains. The arrival of Euroamericans in the Denver Basin beginning around 1860 permanently impacted Native American culture. By the 1880s, Native Americans had been forcibly removed to reservations in southwestern Colorado, Wyoming, and Oklahoma (Church et al. 2007; Clark 1999).

The discovery of gold at the confluence of Cherry Creek and the South Platte River began the Historic period in earnest. Thousands of prospectors and commercial opportunists swarmed to the Denver Basin lured by the incentive of easy wealth. Once the furor of gold abated, many who failed at prospecting tried their luck at ranching and farming. Inexpensive land and ranching opportunities were incentives for Euroamericans to expand north along the Front Range. Ranching and farming were and continue to be the primary commercial enterprises within the project APE. Common historic archaeological sites include: active and/or abandoned farms and ranches and associated facilities; early commercial endeavors such as water diversion projects; and early transportation features such as railroads and roads.

3.18.6 Cultural Resources in the Reservoir Study Areas

The preliminary identification of cultural resources relied on three forms of information retrieval and collection: 1) Class I file and literature searches at the Colorado Office of Archaeology and Historic Preservation; 2) Class I field checks of the proposed Glade, Galeton, and Cactus Hill Reservoir sites; and 3) review of the General Land Office land patenting records and plats. A Class III level pedestrian survey will be conducted for any alternative permitted by the Corps including pipelines and other facilities associated with the permitted alternative. The Class III surveys will be done per the PA (Appendix C) prior to any ground-disturbing activities.

3.18.7 Glade Reservoir APE

Within the APE of Glade Reservoir 45 cultural resources have been previously recorded (WCRM

2007). Sixteen previous cultural resource inventories overlap or intersect the APE. Of the 45 previously recorded cultural resources, 15 are prehistoric, 16 are historic archaeological resources, six are historic water engineering resources, seven are historic, and one has both prehistoric and historic archaeological components.

Of these previously recorded cultural resources, 15 are listed in or eligible for the NRHP (Table 3-26). These include five prehistoric archaeological sites (5LR539, 5LR541, 5LR1692, 5LR2181, and 5LR9932); five historic engineering resources: 5LR749 (Fort Collins Waterworks), 5LR1347 (Charles Hansen Canal), 5LR9649.1 and 5LR9649.2 (two segments of the Poudre Valley Canal), and 5LR9650.1 (segment of the Pleasant Valley Canal); three historic structures: 5LR792 (Pleasant Valley School), 5LR794 (Flowers House), and 5LR964 (Milk House barn); and two railroad resources: 5LR1327 (unrecorded segment of the Rex Branch of the Colorado and Southern/Burlington Northern Railroad) and 5LR1327.5 (a bridge related to the same railroad line). Recorded segments of this railroad have been determined eligible for the NRHP and a similar determination would be expected for this unrecorded segment. The remaining 30 cultural resources include 13 field not eligible recommendations, eight cultural resources that have not been assessed, one field needs data recommendation, four that are officially not eligible, one noncontributing resource to an eligible district, and three isolated finds that, by definition, are not eligible for the NRHP.

The Class I field check conducted within the maximum pool elevation of Glade Reservoir (1,300-acre sample reconnaissance) resulted in the identification of 86 previously unknown cultural resources. These include five prehistoric sites, 13 prehistoric isolated finds, 29 historic sites, 34

historic isolated finds, and five resources of unknown origin.

Table 3-26. Eligible or Potentially Eligible Cultural Sites within the Glade Reservoir APE.

Site #	Site Type	NRHP Status
5LR539	Prehistoric Rockshelter	Eligible, field assessment
5LR541	Prehistoric Open Camp	Eligible, field assessment
5LR749	Historic Engineering	Listed in State Register
5LR792	Historic Architectural	Listed on National Register
5LR794	Historic Architectural	Pending in Washington
5LR964	Historic Structure	Eligible, official determination
5LR1327	Historic Railroad	Eligible, official determination
5LR1327.5	Historic Railroad Bridge	Eligible, official determination
5LR1347	Historic Engineering	Officially Contributes to Eligible District
5LR1692	Prehistoric Stone Circles	Eligible, field assessment
5LR2181	Prehistoric Rock Art	Eligible, field assessment
5LR9649.1	Historic Engineering – Canal	Eligible, official determination
5LR9649.2	Historic Engineering – Ditch	Eligible, field assessment
5LR9650.1	Historic Engineering – Canal	Eligible, official determination
5LR9932	Prehistoric Open Camp	Eligible, official determination

3.18.8 Galetton Reservoir APE

In the proposed Galetton Reservoir APE, 49 cultural resources have been previously recorded (WCRM 2007). Three previous cultural resource inventories and one master's thesis study includes portions of the APE. Of the 49 previously recorded cultural resources, 32 are prehistoric archaeological sites, nine are historic archaeological sites, seven are historic water engineering resources, one is a historic site, and one site contains both prehistoric and historic archaeological components.

Table 3-27. Eligible or Potentially Eligible Cultural Sites within the Galetton Reservoir APE.

Site #	Site Type	NRHP Status
5WL842	Historic Engineering	Eligible, official determination
5WL842.2	Historic Engineering	Eligible, field assessment
5WL842.3	Historic Engineering	Contributing to Officially Eligible District
5WL844.1	Historic Engineering	Eligible, official determination
5WL844.3	Historic Engineering	Eligible, official determination
5WL2296.1	Historic Engineering	Contributing to Officially Eligible District
5WL2296.2	Historic Engineering	Contributing to Officially Eligible District

Seven of these previously recorded cultural resources are eligible for listing in the NRHP (Table 3-27). All are historic engineering resources, including the Cache la Poudre Canal (5WL842), two segments of the Greeley No. 2 Canal/Union Colony Canal No. 2/Cache la Poudre Canal (5WL842.2 and .3), two segments of the Larimer-Weld Canal (WL844.1 and .3), and two segments of the Decker Lateral (5WL2296.1 and .2). The remaining 42

cultural resources within the APE are six sites that are officially not eligible, one site that officially needs data, three sites that are field not eligible, seven sites that have not been assessed, 22 sites that are listed as field needs data, and three sites that are unevaluated Centennial Farms.

The Class I field check conducted within the maximum pool elevation (1,250-acre sample reconnaissance) resulted in the identification of 46 previously unknown cultural resources. These include 10 prehistoric sites, 16 prehistoric isolated finds, seven historic sites, 11 historic isolated finds, and one multi-component site.

3.18.9 Cactus Hill Reservoir APE

Within the APE of the proposed Cactus Hill Reservoir, 83 cultural resources have been previously recorded (WCRM 2007). All of the known cultural resources are located in the 1-mile buffer surrounding the reservoir pool. Eleven previous cultural resource inventories have included portions of the APE. Of the 83 previously recorded cultural resources, 55 are historic archaeological, 20 are historic water engineering resources, and six are prehistoric archaeological.

Table 3-28. Eligible and Potentially Eligible Cultural Sites within the Cactus Hill Reservoir APE.

Site #	Site Type	NRHP Status
5LR706.3	Historic Trail	Eligible, field assessment
5LR778	Historic School	Listed on National Register
5LR782	Historic Agricultural Complex	Eligible, field assessment
5LR787	Historic Residence	Eligible, field assessment

Site #	Site Type	NRHP Status
5LR789	Historic Agricultural Complex	Eligible, official determination
5LR844	Historic Engineering	Eligible, official determination
5LR863	Historic Engineering	Eligible, official determination
5LR863.1	Historic Engineering	Eligible, field assessment
5LR863.2	Historic Engineering	Eligible, official determination
5LR990	Historic Town site	Eligible, official determination
5LR995.1	Historic Engineering	Eligible, field assessment
5LR995.2	Historic Engineering	Eligible, official determination
5LR1327.5	Historic Bridge	Eligible, official determination
5LR1346	Historic Engineering	Contributing to Officially Eligible District
5LR1347	Historic Engineering	Contributing to Officially Eligible District
5LR1572	Historic Agricultural Complex	Eligible, field assessment
5LR1731.5	Historic Railroad	Eligible, official determination
5LR1815.4	Historic Railroad	Eligible, official determination
5LR1817	Historic Agricultural Complex	Eligible, field assessment
5LR1820	Historic Agricultural Complex	Eligible, field assessment
5LR1896	Historic Commercial	Eligible, official determination
5LR3167	Historic Transmission Line	Eligible, field assessment

Site #	Site Type	NRHP Status
5LR9895	Historic Agricultural Complex	Eligible, official determination

Of these previously recorded cultural resources, 23 are eligible or potentially eligible for listing in the NRHP (Table 3-28). These include eight engineering resources, six agricultural complexes, five historic structures, two railroad line segments, one historic trail, and one historic transmission line. Eligibility assessments for the remaining 60 cultural resources include 55 that have been determined not eligible, two that have not been assessed, two that are noncontributing to an eligible district, and one that is listed as needs data.

The Class I field check conducted within the maximum pool elevation area of the proposed Cactus Hill Reservoir (1,000-acre sample reconnaissance) resulted in the identification of 54 previously unknown cultural resources. These include 28 prehistoric isolated finds, 10 prehistoric sites, four historic sites, four historic isolated finds, two historic isolated features, two multi-component sites and one multi-component isolated find. Three paleontological sites were also located.

3.18.9.1 U.S. 287 Abandonment and Relocation Corridors

Nine previously recorded cultural resources are located in or very near the two proposed highway realignment corridor alternatives and the current highway alignment proposed for abandonment. Cultural resources include three prehistoric archaeological sites, three historic archaeological sites, and three historic engineering resources. Three previously recorded cultural resources are eligible for listing in the NRHP (Table 3-29).

Table 3-29. Eligible or Potentially Eligible Cultural Sites within the U.S. 287 Current or Proposed Realignment Corridors.

Site #	Site Type	NRHP Status
5LR1692	Prehistoric Archaeological	Eligible, field assessment
5LR9649.1	Historic Engineering	Eligible, official determination
5LR9930	Unknown Isolated Feature	Eligible, official determination

Eligible cultural resources include a prehistoric archaeological site consisting of stone circles (5LR1692), an isolated feature of unknown cultural affiliation, and a historic engineering resource—a segment of the Poudre Valley Canal (5LR9649.1). Eligibility assessments of the remaining six cultural resources include three sites that have not been assessed and three sites that are listed as field not eligible.

Known but unrecorded cultural resources located in or near the proposed abandoned route or the two proposed realignment alternatives include six linear resources that cross the alignments (the North Poudre Supply Canal; abandoned Colorado & Southern Railroad; the Union Pacific Railroad, and three unnamed irrigation ditches), the Holcim (Ideal) cement plant and mine, a prehistoric rockshelter, and a historic quarry site.

3.18.10 Reclamation Subalternatives

3.18.10.1 No Contract Subalternatives

Both the Glade and Cactus Hill Reservoir alternatives include a Reclamation No Contract Subalternative. Selection of either Glade or Cactus Hill Reservoir alternative would involve the construction of a pipeline between the reservoir and the existing SWSP pipeline below Carter Lake for deliveries to southern Participants. For alternatives

involving Cactus Hill Reservoir, deliveries to the northern Participants would be made via a pipeline connection to the Soldier Canyon Water Treatment Facility and possibly deliveries to the Poudre River and the Larimer County Canal.

Pipeline corridors have not been reviewed for cultural resources. Expected cultural resources within the pipeline alignments would be similar to the findings generated for Glade, Galeton, and Cactus Hill reservoirs. Cultural resources could include both historic and prehistoric archaeological sites. Their frequency depends on whether the alignment is located within existing agricultural fields, within existing rights-of-way (ROW), or undisturbed surfaces. Both historic and prehistoric sites would be expected in agricultural and undisturbed areas. If the alignment is located within an existing ROW, the potential for cultural resources is low. Historic sites could include ranching and agricultural complexes such as abandoned or existing farms or ranches, water conveyance systems, artifact scatters (dumps), and historic roads and trails. Prehistoric sites will predominantly be open artifact scatters and tipi rings. These prehistoric sites could date anywhere from the Paleoindian through the Protohistoric periods (Gilmore et al. 1999).

3.18.10.2 Contract Subalternatives

The Reclamation Contract subalternatives involve an exchange and/or storage contract between the District and Reclamation, and would include a pipeline connection from a new proposed reservoir alternative (Glade or Cactus Hill reservoir) to Horsetooth Reservoir.

3.19 AESTHETICS AND VISUAL RESOURCES

This section addresses the existing visual qualities of both the potential reservoir sites and the potential relocation of U.S. 287. These existing qualities may be affected by the construction of any of the reservoirs or the relocation of U.S. 287. More detailed information is available in either the Visual Resources Comprehensive Technical Report or Visual Resources Technical Report for the Highway 287 Realignment Alternatives (ERO 2008i; ERO and HLA 2008).

3.19.1 Introduction

Two assessments were conducted to determine the potential effects to visual resources: a comprehensive assessment of all proposed facilities in all alternatives including the U.S. 287 realignment alternatives, and an assessment of the U.S. 287 realignment alternatives only. The comprehensive assessment determined areas of visibility, and evaluated effects on existing scenic quality from representative and key observation points. The U.S. 287 assessment included analysis of the potential effects to the existing scenic quality, the sensitivity level of the existing landscape to change, and the visibility of the realignment alternatives from the surrounding area.

The study areas of the proposed dam and reservoir alternatives, and the U.S. 287 realignment alternatives vary in landforms, rock forms, and vegetation communities. The Proposed Action (Alternative 2), Glade Reservoir and SPWCP with Agricultural Transfers (Alternative 4), and possibly the estimated No Action alternative would be located within the High Plains and Foothills visual character regions, described in Section 3.19.2. These landforms include relatively flat prairies, low

elevation mountains, shallow canyons, and channels of creeks and rivers. The vegetation communities vary from low-growing herbaceous plants in the High Plains, to evergreen woodlands of the Foothills. The High Plains region is nearly void of visible rock outcrops; the Foothills region possesses large areas of exposed rocks.

The Cactus Hill Reservoir and the SPWCP alternative (Alternative 3) would be wholly located in the High Plains region. These areas are characterized by treeless prairie with some visible lines of trees and shrubs associated with creeks, rivers, or canals. Most of these locations have distant westerly views of the Rocky Mountain Front Range.

Areas with the highest quality of visual resources are typically characterized by the absence of man-made forms and the presence of a variety of landforms; rock forms; water forms such as lakes, rivers, and creeks; and vegetation indigenous to the study area's region. These features are the primary physical characteristics that determine the region's visual character, defined as character regions.

3.19.2 High Plains Character Region

The High Plains character region is located east of the hogbacks northwest of Fort Collins. The landforms are predominantly low-lying, long, subtle hills. The region is nearly void of visible rock outcrops and trees. Vegetation is predominantly low-growing grasses, forbs, wildflowers, and cacti. This region contains multiple depressions with arroyos, creeks, and the Cache la Poudre River. These depressions typically support trees and shrubs, significantly altering the visual character of the prairie. Along the creeks and the Cache la Poudre River, these narrow, linear areas are composed of cottonwood and Russian olive trees, native willows,

and salt cedars. These riparian plant communities are typically continuous along the streambanks.

Many small lakes and ponds are also located in the High Plains character region. The perimeters of these water bodies comprise vegetation communities similar to the creeks and rivers. However, most of the small lakes are also surrounded by residences, such as those at Black Hollow Reservoir, Cobb Lake, and Long Lake. These residences are all single-family houses, including some with multiple outbuildings and trees and shrubs.

Small towns such as Ault, Galeton, and Pierce are located in the High Plains character region. These towns possess similar visual characteristics including single-family houses with outbuildings or detached garages, two city block lengths of small commercial businesses, a variety of agricultural businesses located near the town limits, and a single city park adjacent to a main transportation route. Due to the mostly unobstructed views within this character region, towns create a contrast on the otherwise open prairie.

The prairie landscape is also represented regionally by the Pawnee National Grassland and two SWAs, Wellington and Webster. However, these public land use areas are undeveloped except for relatively small entrance signs and wire fencing. Therefore, they do not create visible contrasts within the character region.

The visual resources of the High Plains character region are dominated by the absence of obstructions to views in any direction. Distant mountains are typically visible to the west, and vast areas of the sky and changing climatic conditions exist in all views. Views in this character region have only subtle variations in landform, color, and texture; except within or near the riparian corridors of creeks, rivers, or lakes and ponds; and in and near

the small towns. Visible rock forms are mostly absent.

3.19.3 Foothills Character Region

The Foothills character region includes the low mountains, geological hogback formations, and valley of the existing U.S. 287 corridor. The region is predominantly characterized by ponderosa pine-covered foothills and low mountains. These landforms also comprise highly visible large rock outcrops and boulders.

The region is dominated by a large, open valley with foothills land forms, rock outcrops, rocky mesas (of the hogback formations), scattered evergreen trees, and a few visible single-family homes. The valley is covered with grasses, forbs, low-growing shrubs, and scattered ponderosa pine trees. Artificial forms are mostly absent from most views.

The decommissioned Holcim Mine, a Portland Cement source, is within the Foothills character region, and represents a noticeable change in landform and vegetation type. The Holcim Mine has recently ceased all excavation and material processing operations, and has been partially reclaimed through earthwork and seeding. Landforms within the Holcim Mine property are composed of smooth-faced, deep depressions adjacent to steep-sloped and narrow-topped hills. These landforms are visibly different from the nearby hogback formations and prairie landforms. Most of the Holcim Mine property has recently been seeded. The seeding has an unvarying appearance due to the mulch application, and is without surface rocks or rock outcrops. This has created a noticeable contrast with the adjacent undisturbed landscape of varying plant communities and exposed rocks.

Views in this region are predominantly unobstructed and extend to the adjacent mountain and mesa tops,

and are void of artificial distractions. A few single-family homes on the western side of the valley, wire fences, and gravel roads are the only artificial forms visible. All views in this character region have variety in landforms, rock forms, color, and texture.

3.20 TRAFFIC AND TRANSPORTATION

The following discussion summarizes the areas that may have traffic or transportation impacts due to the construction of reservoirs, forebays, or the potential relocation of U.S. 287. More detailed information on traffic and transportation is provided in the Land Use Technical Report (ERO 2008g).

The construction of Glade Reservoir or Cactus Hill Reservoir would inundate existing roads and require the relocation of the inundated roads. These roads include state highways as well as county roads and other local access roads.

3.20.1 Glade Reservoir Study Area

About 7 miles of U.S. 287 travels through the Glade Reservoir study area, and would be inundated by the construction of Glade Reservoir under Alternatives 2 and 4 and would be realigned (Figure 3-19).

3.20.1.1 Glade Dam and Reservoir

3.20.1.1.1 Site Location

The proposed Glade Dam and Reservoir would be located just north of the intersection of U.S. 287 and State Highway (SH) 14, which is just northwest of Fort Collins in unincorporated Larimer County. The location of the reservoir is such that a portion of highway U.S. 287 will need to be relocated. The realigned portion of U.S. 287 will tie-in to the existing U.S. 287 near Owl Canyon Road on the north and Overland trail on the south end. In the

vicinity of the project, U.S. 287 and SH 14 run concurrently until Ted's Place, at which point SH 14 continues westward into the Poudre Canyon and U.S. 287 turns to the north. It is just north of this divergence of the highways that the Glade Dam and Reservoir are proposed to be constructed. See Figure 3-19 for an illustration of the existing and proposed U.S. 287 alignments.

3.20.1.1.2 Current Roadway Network

The land surrounding the proposed Glade Reservoir is primarily agricultural, and therefore, roads in the area are limited. U.S. 287, which currently runs directly through the proposed site location, is the main arterial in the immediate vicinity. SH 14 intersects U.S. 287 directly south of the site (this corner is also known as Ted's Place), and is the main east/west arterial in this region. Both of these highways provide regional connectivity throughout the state. Several local roadways, under the jurisdiction of Larimer County also have direct access to U.S. 287. These local roads include Larimer County Road (LCR) 23E, LCR 54G/56, and LCR 54; all of which are just southeast of the proposed site location, providing access to the towns of Laporte and Bellvue. On the northern part of this section of the U.S. 287 corridor the intersecting roads include Bonner Spring Ranch Road and Owl Canyon Road (also LCR 72). Bonner Spring Ranch Road is a private roadway accessing ranchland to the west of the highway. Owl Canyon Road provides local access to the northern outskirts of the town of Wellington.

3.20.1.1.3 Functional Classification and Use

U.S. 287, which is part of the National Highway System (NHS), is designated as a rural principal arterial and provides north/south connectivity between states. It has an access designation of expressway (EX) which means that only limited access (typically 1-mile spacing), is allowed along this facility. The existing speed limit on U.S. 287 is

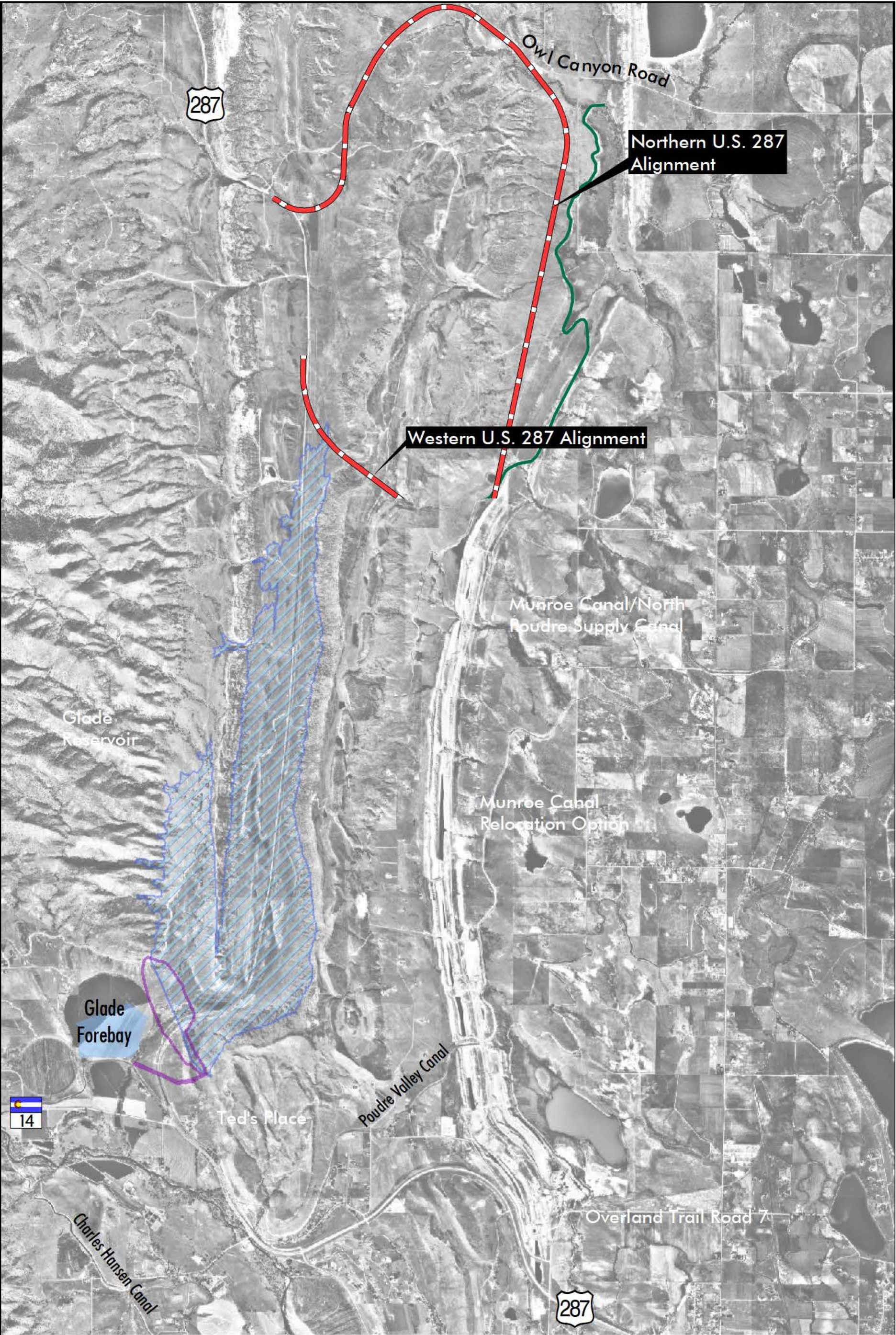


Figure 3-19
U.S. 287 Western and
Northern Realignment Alternative

Prepared for: U.S. Army Corps of Engineers
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January 3, 2008

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65 miles per hour (mph). It is a designated truck route.

SH 14 is a two-lane east/west regional arterial, which is not on the NHS, but is classified by the State of Colorado as a Minor Arterial-Rural highway. In the vicinity of the site, the posted speed limit is 45 mph; it is a designated truck route and is under the jurisdiction of CDOT, Region 4. The access control designation is that of Rural Regional Highway, which means that acceptable spacing of intersections and other access locations is at 0.5-mile intervals.

3.20.1.1.4 Current Traffic Counts

Existing Average Daily Traffic (ADT) volumes along U.S. 287, north of the SH 14 intersection, show an average of 5,500 vehicles per day (vpd) as recorded by CDOT in 2005. Southeast of the SH 14 intersection, the recorded volumes on U.S. 287 near Overland trail increase by 2,000 vehicles to approximately 7,600 vpd. Year 2005 volumes along SH 14, west of Ted's Place, were approximately 2,400 vpd.

3.20.1.1.5 Crash/Accident Data

Crash data available from CDOT for the 5-year period between January of 1999 and December of 2003 found that 90 accidents were reported along U.S. 287 between Ted's Place and Owl Canyon Road. Of those accidents, 28 percent were reported to have involved a fixed object, and 27 percent resulted from collisions with an animal. Five of the accidents were reported as fatalities, and three of those were associated with drugs or alcohol.

3.20.1.1.6 Construction

During construction of the dam and reservoir, a minimal increase in traffic associated with workers accessing the site can be expected on the roads in the immediate vicinity.

3.20.2 Cactus Hill Reservoir Study Area

3.20.2.1.1 Site Location

The Cactus Hill Reservoir, which is being considered as an alternative to the Glade Reservoir, would be located in Weld County, east of I-25 and approximately 2 miles north of SH 14. The proposed site is also adjacent to the Black Hollow Reservoir (Figure 2-3).

Portions of the following Weld County Roads (WCRs) in the Cactus Hill Reservoir study area would be relocated or partially inundated:

- WCR 15 (north-south)
- WCR 19 (north-south)
- WCR 23 (north-south)
- WCR 86 (east-west)
- WCR 90 (east-west)
- WCR 92 (east-west)
- WCR 94 (east-west)

3.20.2.1.2 Current Roadway Network

The roads surrounding the proposed Cactus Hill Reservoir site are under Weld County's jurisdiction, and are undivided, two-lane gravel roadways. The main roads in the vicinity of the site are SH 14, WCR 15, and WCR 19.

3.20.2.1.3 Functional Classification and Use

SH 14 is a two-lane east/west regional arterial, which is not on the NHS, but is classified by the State of Colorado as a Minor Arterial-Rural highway. In the vicinity of the site, the posted speed limit is 65 mph; it is a designated truck route and is under the jurisdiction of CDOT, Region 4. The access control designation is that of *Rural Regional Highway*, which means that acceptable spacing of intersections and other access locations is at 0.5-mile intervals.

WCR 15 is a north/south roadway that is classified as a local county road. It provides access to other local roads in the area. North of SH 14, WCR 15 is a paved two-lane roadway until a location approximately 3 miles north of the highway, after that, it transitions to a two-lane gravel roadway that is not heavily utilized and terminates at WCR 96. WCR 15 will be directly impacted if the Cactus Hill Reservoir is built.

WCR 19 is a north/south roadway that is classified as a local county road. It provides connectivity between SH 14 and WCR 100 (or Nunn Road). WCR 19 is primarily a two-lane gravel roadway. WCR 19 will be directly impacted by the proposed Cactus Hill Reservoir.

WCR 90 is an east/west roadway, classified as a local county road, which provides connectivity to U.S. 85 in the Town of Pierce, approximately 7 miles east of the proposed Cactus Hill Reservoir site. Outside of Pierce, WCR 90 is a two-lane gravel road that is not heavily utilized in the immediate vicinity of the site. WCR 90 will be directly impacted by the proposed Cactus Hill Reservoir.

3.20.2.1.4 Current Traffic Counts

Weld County periodically monitors unimproved local roads to determine if and when paving is necessary. Typically, if ADT volumes on a particular segment of road exceed a level of 200 vpd for more than three consecutive days, and are found to maintain that level of use three months later, then the County will investigate the possibility of improving that segment of road to a paved surface. Weld County has limited ADT volumes, in and around the proposed Cactus Hill site.

The volumes along WCR 15 range between 78 vpd and 975 vpd. The higher volumes reflect recent growth in residential developments. A similar trend (though not as drastic a difference) occurs along WCR 19, which carries between 40 and 150 vpd.

The heaviest volumes in the vicinity of the proposed site are found along SH 14, which carries an average of 7,700 to 8,600 vpd. Traffic volumes on SH 14 were obtained from the CDOT website; it is unknown when these volumes were recorded.

3.20.2.1.5 Crash/Accident Data

Weld County provided crash data from January 2003 through October 2006. The data set includes all crashes that occurred within the immediate area of the proposed site, including those along SH 14 that occurred between the Weld County Line and WCR 23. Within the studied time frame, 73 accidents were recorded, the majority of which (68 percent) involved property damage only, 30 percent resulted in injury, and two percent were fatalities. Both fatal accidents occurred on SH 14 and resulted from failing to stop properly at an intersection.

The majority of crashes recorded were found to have occurred on the following three roadways: SH 14 (55 percent or 40 total crashes), WCR 15 and WCR 84 (8 percent or six total crashes each), and WCR 19 (7 percent or five total crashes). Most of these resulted from inattentive driving or speeding.

3.20.2.1.6 Site Assumptions and Future Conditions

It is anticipated that any traffic associated with the Cactus Hill Dam and Reservoir would be minimal. In general, only vehicles associated with the daily operation and maintenance of the facility are expected to access the site. Public recreational activities are not proposed. It is reasonable to assume that the new roadways built to accommodate the realignment of WCR 15 and the inundation of sections of WCR 19 and WCR 90, will be sufficient to accommodate existing traffic volumes, as well as any site generated traffic and future growth in the area.

During construction of the dam and reservoir a minimal increase in traffic associated with workers

accessing the site can be expected on the roads in the immediate vicinity.

3.20.3 Galeton Reservoir Study Area

3.20.3.1 Galeton Reservoir

3.20.3.1.1 Site Location

The proposed Galeton Reservoir will be located in Weld County, approximately 10 miles directly east of the Town of Ault, south of the Pawnee National Grassland, and just northeast of the Town of Galeton, in a predominantly agricultural area. Galeton Reservoir is common to all action alternatives.

3.20.3.1.2 Current Roadway Network

The roads surrounding the proposed Galeton Reservoir site are undivided, two-lane gravel roadways. The two main roads in the vicinity of the site are SH 14 to the west and north, and WCR 51 to the southwest.

3.20.3.1.3 Functional Classification and Use

SH 14 is a two-lane east/west regional arterial, which is not on the NHS, but is classified by the State of Colorado as a *Minor Arterial-Rural* highway. In the vicinity of the site, the posted speed limit is 65 mph; it is a designated truck route and is under the jurisdiction of CDOT, Region 4. The access control designation is *Rural Regional Highway*, which means that acceptable spacing of intersections and other access locations is at 0.5-mile intervals.

WCR 51 is a north/south roadway that is classified as a local county road. It is located approximately 2 miles west of the proposed reservoir site and provides regional connectivity between SH 14, SH 392, and SH 263. South of SH 14, WCR 51 is a paved two-lane roadway, also known as Main Street through the Town of Galeton. North of SH 14, it is

a two-lane gravel roadway that is not heavily utilized and terminates at WCR 90.

WCR 49, which is 1 mile west of WCR 51 (approximately 3 miles west of the proposed Galeton Reservoir), has been identified by the County as a “strategic roadway.” This corridor has been chosen as the preferred alignment for a north/south regional arterial east of Greeley. A study regarding this corridor was conducted in October of 2004. There are currently no known plans for construction to begin.

3.20.3.1.4 Current Traffic Counts

Weld County has had substantial growth in population and traffic. Therefore, many unimproved local roads are being closely monitored to determine if and when paving is necessary. The ADT on Weld County roads in the vicinity of the Galeton Reservoir site range from a high of 154 vpd on a segment of WCR 51 to a low of 42 vpd on a segment of WCR 76. The segment of SH 14 northwest of the Galeton Reservoir site has an ADT of 1,200 vpd.

Traffic volumes in and around the Galeton Reservoir site are relatively low. The areas to the south have greater traffic volumes because those areas are experiencing growth in residential developments. Excluding the average daily volume along SH 14, WCR 51 currently carries the majority of local traffic volumes in the vicinity of the site. However, if and/or when WCR 49 is upgraded, it is expected that some of the volumes currently recorded along WCR 51 will shift to WCR 49.

3.20.3.1.5 Crash/Accident Data

Weld County provided crash data from January 2003 through October 2006. This data was a compilation of reports filed by the Colorado State Patrol or the Weld County Sheriff’s Department. The data set includes all crashes that occurred within a 4-mile radius of the proposed Galeton Reservoir site. From

January 2003 through October 2006, 46 crashes were recorded. The majority of crashes recorded were found to have occurred on the following three roadways: SH 14 (40 percent or 17 crashes), WCR 74 (26 percent or 12 crashes), and WCR 51 (17 percent or eight crashes). These crashes primarily resulted from inattentive driving. Nearly 60 percent of all accidents involved property damage only, 14 crashes (or 30 percent) resulted in injury, and five crashes (10 percent) were fatalities. Of the five fatal crashes, three occurred on SH 14, and all appear to have resulted from inattentive driving.

3.20.4 Other Study Areas

All of the pipeline study areas (SPWCP pipelines, Glade to Horsetooth pipeline, Cactus Hill to Horsetooth pipeline, and the Carter pipeline) and the Poudre Valley Canal study area contain federal, state, and/or local roads. The proposed pipeline alignments would cross a number of roads used for local, state, and in some cases, interstate travel.

3.21 LAND USE

This section details the existing land uses in the NISP land use study area that may be affected by the construction of reservoirs, dams, forebays, or other proposed facilities associated with NISP. More details on land uses are presented in the Land Use Technical Report (ERO 2008g).

3.21.1 Regulatory Framework

With few exceptions, local governments are not required to adhere to uniform land use plans or standards. Instead, counties and incorporated towns can determine their own land use visions, priorities, policies, and plans. The result is a wide range of land uses affecting the landscape differently

throughout the region in which NISP alternatives occur. This is accomplished by local governments through zoning ordinances, master plans, open space and natural area plans, urban growth boundaries, growth management areas, cooperative planning areas and community influence areas. As described in the following sections, each of the NISP Participants and counties in which they occur have taken measures to address and manage the significant future growth estimated for the region.

3.21.2 Land Use and Growth

Much of the area in which the NISP Participants occur is characterized by rapid growth and land use changes. NISP is proposed to meet a portion of the future water supply needs of the Participants as discussed in Chapter 1. A portion of the water to be supplied by NISP is already needed by some of the Participants to meet existing demands, and the remainder of the water that would be supplied by NISP is designed to help the Participants meet a portion of projected water demands associated with the projected population growth for the region. The following sections describe these land use and growth trends.

3.21.2.1 Growth and Land Use within the Region

In 2000, Colorado's population was about 4.3 million. The U.S. Census Bureau projects that Colorado's population will increase to about 5.8 million by 2030 (34.9 percent) (U.S. Census Bureau 2000). The NISP Participants are located within Boulder, Larimer, Morgan, and Weld counties in northern Colorado, with a combined population of 750,889 in 2000. These four counties represent about 17 percent of the total population of Colorado.

The NISP project area is located along the foothills and rolling grasslands east of the Rocky Mountains in northern Colorado. This eastern part of Colorado

is part of the High Plains region of the Great Plains of the central United States. Land within the project area is known for its fertile soil and some of the most productive agricultural enterprises in the state.

Until the 1960s, the northeastern Colorado economy focused on agriculture and other related industries. Currently, 50.8 percent of the total acreage is designated as agriculture; however, this percentage continues to drop as rapid population growth results in land use changes. Additionally, low commodity prices, increased property taxes, and impacts from urbanization drive many farmers and ranchers to sell their land.

Between 1960 and 1990, large-lot development (2 to 40 acres) grew three times faster than the population growth. Colorado's northeast region (Boulder, Broomfield, Jefferson, Larimer, Logan, Morgan, Sedgwick, and Weld counties) is projected to lose 555,000 acres of farmland between 2002 and 2022 (Environment Colorado Research and Policy Center 2006).

3.21.2.2 Counties

As mentioned previously, NISP Participants are located within four counties of northern Colorado (Boulder, Larimer, Morgan, and Weld). Each of these counties is unique in landscape, size (land mass and population), and land use (historical and future approaches).

3.21.2.2.1 Boulder County

Located in the southwestern corner of the project area close to Denver, Boulder County is more commonly associated with the Denver metropolitan area than it is to northern Colorado. Of the four counties, Boulder County is the smallest in terms of land mass (741 square miles; 474,320 acres), but has the largest population (291,288). Boulder County has experienced steady population growth from the

1960s with an average annual growth of 3.58 percent (Boulder County Land Use Department 2006).

NISP Participants (Lafayette, Left Hand Water District, and Erie) are located in the eastern half of Boulder County. The eastern half of Boulder County hosts lush farmland, permanently protected open space, three urban centers (Cities of Boulder, Longmont, and Lafayette), several smaller towns, and residential and commercial development in the unincorporated portions of Boulder County. Once a rural farming community, Boulder County has changed significantly due to population increases and economic shifts over the last 15 to 20 years.

The rate of population growth in Boulder County was slower than rates in other regions as reflected by the smaller rates of change in population for Lafayette and the Left Hand Water District at rates of 2.1 percent and 4.5 percent, respectively. Although these rates are relatively lower, compound growth rates of 2 percent and above are generally perceived as healthy growth. There are several reasons for this difference in rate of growth in Boulder County. Much of the fast-paced residential growth for Boulder County occurred in the 1990s when total population growth increased almost 30 percent compared to an estimated 3 percent increase from 2000 to 2005. Additionally, the City of Lafayette in Boulder County has placed growth restrictions on development so that no more than 200 units can be built per year.

In the last 15 years, a substantial amount of farmland in Boulder County has been taken out of production and the size of farms has decreased. As of 2002, 115,998 acres of Boulder County were being farmed on 756 farms. While the number of farms remained fairly constant, 39,490 acres of farmland were taken out of production between 1987 and 2002. As a result, the average farm size dropped from 207 acres to 146 acres in that 15-year period (USDA-NASS

2002). Much of the agricultural land conversion was the result of new home construction. For example, in 1998 alone, 4,977 new homes were built in Boulder County (Boulder County 2000).

The Boulder County Comprehensive Plan was developed so that “growth should be channeled to municipalities, agricultural lands should be protected, and preservation of our environmental and natural resources should be a high priority in making land use decisions.” To achieve these goals, Boulder County has worked with the incorporated communities to identify Community Service Areas (CSAs). Areas within CSAs are identified as urban centers, while those areas outside the CSAs are intended to remain rural in character (Boulder County 1999). Most future development is expected to occur within incorporated communities with a decline of development in the unincorporated portions of Boulder County. The Boulder Valley Comprehensive Plan (Year 2000 Major Update) addressed growth issues in Boulder County and was listed in the 2001 Smart Growth Hall of Fame (Kramer 2001).

Additionally, in the mid-1960s, the Boulder County Parks and Open Space Program was initiated to promote and provide for the preservation of open space, environmental and cultural resources, and nonurban recreational opportunities (Boulder County Parks and Open Space Department 2006). To date, the program is responsible for the protection of over 70,000 acres.

3.21.2.2.2 Larimer County

Larimer County is in north-central Colorado and represents the northwest corner of the NISP region. Larimer County is the seventh largest county in terms of population in Colorado. Among the four counties with NISP Participants, Larimer is the second most populous and the second largest in terms of land mass (2,640 square miles). Over 50

percent of Larimer County is publicly owned including Roosevelt National Forest, Rocky Mountain National Park, Colorado State Parks and Recreation Areas, Larimer County Parks, and local parks.

Between the 1970 and 2000 U.S. Censuses, the county’s population nearly tripled from 89,000 residents to 251,494. As a result, the population density rose to 96.7 people per square mile. In the 10-year period between 1990 and 2000, Larimer County’s growth rose 35.1 percent (U.S. Census Bureau 2000). Larimer County Planning Division’s 2005 population estimate is that 280,051 people live in Larimer County and predicts that by 2025 Larimer County’s population will grow to 402,782 (Larimer County Planning and Building Services Division 2004).

According to the 2002 U.S. Census of Agriculture, Larimer County had 521,599 acres of farmland as part of 1,564 farms (USDA-NASS 2002). From 1987 to 2002, Larimer County lost over 40,000 acres of farmland (Economic Research Service 2005). Hay and livestock production represent more than 80 percent of the agriculture sector within Larimer County (USDA Census of Agriculture 2002).

Residential development in Larimer County has outpaced population growth by 3.73 percent, which indicates that land use changes are occurring at a more rapid rate than population trends predict (Compass of Larimer County 2005).

Larimer County has undertaken a variety of measures to shape and manage growth. Larimer County, Fort Collins, and Loveland have entered into Intergovernmental Agreements (IGAs) for the purpose of designating growth management areas (GMAs), cooperative planning areas (CPAs), and community influence areas. The IGAs are intended to help guide development in a cooperative, orderly manner. The Larimer County Master Plan

establishes GMA boundaries where urban level services are to be located within the next 20-year planning horizon. GMAs are areas currently within or adjacent to Fort Collins, and Loveland. CPAs are those areas that are not planned for urban development and/or urban services within a city planning horizon (i.e., 20 years), but where development may have an impact on present and future city growth patterns (Larimer County Planning Department 1996).

Larimer County has an active open lands acquisition program that has preserved more than 38,000 acres of fee title acquisitions and conservation easements since the program's inception in 1995. In 2001, Larimer County adopted an Open Lands Master Plan that identified the following acquisition priorities: river corridors, important natural resource areas, important agricultural areas, and regional trail corridors (Larimer County 2001). In 1996 Larimer County Commissioners formally adopted the Rural Land Use Process. The process provides an alternative to the division of land into 35-acre parcels and assists land owners that wish to develop their property while maintaining most of their land for agriculture and open space. This process was listed in the 2001 Smart Growth Hall of Fame (Kramer 2001).

The only NISP participant located wholly within the boundaries of Larimer County is the FCLWD. The Town of Windsor is partially in Larimer County, but is primarily within Weld County.

3.21.2.2.3 Morgan County

The NISP participants within Morgan County include Fort Morgan and Morgan County Quality Water. Morgan County is located on the eastern edge of the NISP region. Morgan County covers 1,296 square miles but has only a few incorporated communities: Fort Morgan (the county seat), and the towns of Brush, Hillrose, Log Lane Village, and

Wiggins. As of the 2002 Census of Agriculture, Morgan County farmers owned 761 farms comprising 757,946 acres of farmland. Unlike the other counties with NISP Participants, Morgan County added more farmland (14,683 acres) from 1987 to 2002 (NASS 1987, 2002).

Morgan County's population is small compared to the other counties in the NISP region. In 1970, the population was 20,105. By 2002, the population had risen to 27,171. The 2002 population represents a population density of 21.1 per square mile (U.S. Census Bureau 2000). The most rapid development has occurred in the last few years with an increase of 1,000 people between 2000 and 2003. The Department of Local Affairs (DOLA) (2006) predicts that Morgan County will grow at a steady rate through 2035 to a population of 52,171.

The Morgan County Comprehensive Plan (2004) sets out goals to protect important natural resources such as prime agricultural lands by:

- Preserving prime agricultural lands in areas outside of municipality planning areas to the greatest extent practicable
- Discouraging general rezoning of agricultural lands outside of designated development areas
- Coordinating with the municipalities on land use allocations within their planning areas
- Cooperating with other agencies helping agriculture producers

3.21.2.2.4 Weld County

The NISP Participants located within Weld County include Central Weld County Water District, Eaton, Evans, Severance, and Windsor.

Weld County is the third largest county in Colorado with a land mass of 3,999 square miles. Weld County is Colorado's leader in cattle, sugar beet, and grain production (Colorado Department of Agriculture 2003). Weld County is the most

productive county in Colorado in terms of value of agricultural products sold (USDA-NASS 2002).

As of 2002, Weld County hosted 3,121 farms consisting of 1,812,167 acres or about 6 percent of the farmland in Colorado (USDA-NASS 2002). Population growth and new development have reduced farming acreages. From 1987 to 2002, 272,982 acres of agricultural land was taken out of production in Weld County (Agriculture, Economic Statistics and Market Information System 2004).

Weld County is one of the Colorado's fastest growing counties with a 16.8 percent increase between 2000 and 2003. Weld County's population has more than doubled in the last 30 years (DOLA 2006). The 2000 U.S. Census documented Weld County's population at 180,936. The population density was 45.3 per square mile. The population change between 1990 and 2000 was 37.3 percent (U.S. Census Bureau 2000).

3.21.2.3 Participants

The Participants have experienced significant growth and anticipate significant future growth (Table 3-30). The combined Participant service area has an estimated population of roughly 188,000 people as of 2006 (Table 3-30). The Participant communities are generally rural in nature. The largest jurisdiction in the combined service area is the FCLWD with about 36,440 people while Severance, the smallest community, has about 1,600 people. Several of the Participants have developed growth boundaries and influence areas to manage growth and land uses.

Dacono's planning area identified in its Comprehensive Plan is about 22 square miles or about 14,080 acres. The planning area is conducive to development because of its relatively flat terrain (there are no steep slopes in any portion of the planning area), modest prices, and accessibility to

Denver metropolitan and northern Colorado communities.

The Firestone Comprehensive Plan identifies an urban growth boundary that is about 14 square miles.

Erie's current annexed area includes about 14 square miles; however, its comprehensive planning area (including areas outside of the Town's incorporated area) extends over 46 square miles.

The incorporated area of the City of Evans is currently 3,430 acres, of which about 1,470 are developed and 225 acres are planned to remain as open space. The remaining land is mostly platted for residential development. Evans has identified an urban growth boundary area that encompasses an area of 26.7 square miles (City of Evans 2006).

Highway SH 392 forms a natural boundary between the Town of Severance and the Town of Windsor. However, the urban growth boundaries of the towns conflicted along the section of SH 392 between Windsor and Severance, leading to potential conflict and incompatible development in both communities. The towns developed an IGA concerning future development that:

- Solidified the growth boundaries where the two towns meet;
- Created a CPA for joint planning; and
- Coordinated the development of an efficient and well-planned water and sewer service for the CPA.

The IGA was listed in the 2001 Smart Growth Hall of Fame (Kramer 2001).

Windsor's growth management area boundary covers approximately 26,050 acres. The area is bounded by I-25 on the west, WCR 78 on the north, WCR 23 on the east, and SH 34 on the south. (See discussion of Severance above.)

Table 3-30. Population in NISP Study Area, 2000–2006.

	Actual 2000	Actual 2003	Estimate 2004	Estimate 2005	Estimate 2006	Annual Compound Growth Rate 2000–2006
CWCWD	4,972	5,436	5,599	5,948	6,221	4.0%
Dacono	3,015	3,193	3,309	3,404	3,452	3.4%
Eaton	2,690	3,702	3,825	4,655	4,959	10.7%
Erie	6,291	8,930	10,216	12,478	13,526	13.2%
Evans	9,514	14,288	16,280	17,800	18,512	11.7%
FCLWD	23,529	30,377	33,138	34,788	36,438	7.6%
Firestone	1,908	5,070	5,748	7,100	7,199	24.8%
Fort Lupton	6,787	7,116	7,111	7,900	8,098	2.7%
Fort Morgan	11,034	11,013	11,119	11,400	11,594	0.3%
Frederick	2,467	5,320	5,905	6,700	6,794	17.4%
Lafayette	23,197	23,580	23,704	24,319	24,827	2.1%
LHWD	17,113	18,158	18,685	19,226	19,784	4.5%
MCQWD	4,772	5,732	5,914	6,160	7,322	7.4%
Severance	597	1,180	1,563	1,500	1,620	18.1%
Windsor	9,886	12,193	12,711	16,200	17,294	9.2%
Total	127,772	155,288	164,827	179,567	187,640	6.6%

Source: HDR and BBC 2007.

3.21.3 Land Use at Alternative Reservoir Sites

3.21.3.1.1 Glade Reservoir Study Area

Almost the entire proposed Glade Reservoir site is currently owned by the District and is not open for public use. The District leases a portion of the Glade Reservoir study area to a tenant who uses the property for agricultural purposes, including cattle grazing and hay production. A second tenant has a permitted quarry for mining rock from the hogback between the existing U.S. 287 alignment and the Holcim Mine area. One private landowner owns a residential property at the northern end of the Glade Reservoir study area. A small area on the western side of the Glade Reservoir study area is the Poudre

River State Trust Land, owned by the State Land Board and leased by the CDOW to allow public access for fishing year-round and deer and small game hunting at specified times of the year. Another small portion on the eastern side of the Glade Reservoir study area is owned by the BLM. There is no current grazing permit on this parcel and there is no public access to it. If Glade Reservoir is constructed, the District would pursue either an exchange or a purchase of this parcel with the BLM. Glade Reservoir would inundate about 7 miles of U.S. 287 and the ROW is owned by CDOT. If Glade Reservoir were constructed, the District would provide an alternative ROW for the realigned portion of U.S. 287 and CDOT would abandon the portion of U.S. 287 that would be inundated.

3.21.3.1.2 Galeton Reservoir Study Area

Most of the Galeton Reservoir study area is privately owned and is not open to public use. The majority of the Galeton Reservoir study area is used for cattle grazing. Two quarter sections owned by the State Land Board are located in the southwestern corner of the study area. One quarter section is leased for grazing, and the other is leased for dry land crop production. The northernmost portion of the Galeton Reservoir study area borders the administrative boundary of the Pawnee National Grassland. Nearly the entire proposed Galeton Reservoir forebay lies within the Mitani-Tokuyasu SWA owned and managed by the CDOW for wildlife-related recreation such as waterfowl hunting and photography.

3.21.3.1.3 Cactus Hill Reservoir Study Area

Almost the entire Cactus Hill Reservoir site is owned by Anheuser-Busch and is not open for public use. It is used for disposal of wastewater associated with beer production. Some areas of the Cactus Hill Reservoir site are privately owned by other landowners, and are used for agricultural purposes such as crop production and cattle grazing. The State Land Board owns some land in the northeastern corner of the Cactus Hill study area. Some of this land is in the CRP and is not in production and another portion of these lands are leased to a grazing permittee.

3.22 SOCIOECONOMIC RESOURCES

This section presents a summary on the existing socioeconomic resources within the NISP study area that could be affected by the proposed project. More detailed information is provided in the Socioeconomic Resources Technical Report (HDR and BBC 2007).

3.22.1 Regulatory Framework

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, was issued by former President Clinton on February 11, 1994. The objectives of the Executive Order are to identify low-income and minority populations where proposed federal actions have disproportionately high and adverse socioeconomic environmental effects, and to enable the participation of minority and low-income populations in the project planning. “Environmental justice” is the term used to describe fair and equitable treatment of minority and low-income populations with regard to all discretionary federal actions. The Corps and Reclamation have discretionary federal actions associated with the proposed project; therefore, an environmental justice review is required.

In addition to environmental justice populations, additional underrepresented populations must be identified. The term “environmentally sensitive populations” refers to all populations that must be considered for social affects. With respect to NISP, those additional underrepresented populations include the elderly. The reason for including the elderly population is the potential for higher municipal water bills associated with the project and the fixed nature of many elderly incomes.

3.22.2 Socioeconomic Issues

Socioeconomic issues identified in scoping were:

- Effects to rate payers in each affected community, including potential impacts to minority and low income households
- Effects to minority and low income households affected by U.S. 287 relocation
- Effects to irrigators involved in land retirement or water exchanges
- Effects to regional population growth

- Effects to the regional economy from project construction and possible retirement of irrigated farm lands

The study area for the assessment of socioeconomic issues includes the current and future water service areas of the Participants (combined service area), as well as the water service areas of the four water districts located within Larimer, Weld, Morgan, and Boulder counties (CWCWD, FCLWD, LHWD, and MCQWD).

The study area has an estimated population of about 193,500 as of 2006. From 2000 to 2006, the overall annual compound growth rate for the study area was 6.7 percent (Table 3-30). Each community showed positive population growth over the 6-year period. Although those communities with the highest compound growth rates were located in Weld County (Firestone 24.8 percent, Severance 18.1 percent, and Frederick 17.4 percent), vast differences occur in the growth rates within the same county and among other small communities. For instance, Dacono in Weld County had a 3.4 percent compound growth rate. Fort Morgan in Morgan County had the lowest growth rate at 0.3 percent. Growth in the region is further discussed in the Land Use and Growth section. The socioeconomic and demographic characteristics of the region are described in detail in the Socioeconomic Resources Technical Report (HDR and BBC 2007).

3.22.2.1 Environmentally Sensitive Populations in the Participant Service Area

The majority of the households in the study area are white, but ethnic diversity is evident among all of the Participant communities. Those of Hispanic origin have a strong presence in the study area. Hispanics comprise about 20 percent of the total

population of the study area. This exceeds the average in the state (17.1 percent) (HDR and BBC 2007).

In terms of poverty, the communities of Lafayette, Evans, Fort Lupton, and Fort Morgan had the highest numbers of people in poverty, combining for over 40 percent of the total people below the poverty line in the combined service area. Of those aged 65 or older, roughly 7 percent of the population in the study area are below the poverty line.

3.22.2.2 Water Rates

One of the major socioeconomic issues associated with NISP is the potential economic effect of residential water rates for the customers of the Participants. The following is a summary of current residential water rates for each of the NISP Participants. A common benchmark for affordability is that water service should not exceed more than 2 percent of household income (HDR and BBC 2007).

Residential water rates currently range from \$33 per month (Eaton) to \$76 per month (LHWD). These fees amount to between 0.54 percent and 2.31 percent of median household incomes in the Participant communities. Five jurisdictions in the study area currently have water utility charges that are close to the benchmark of 2 percent for water service: Evans, Fort Morgan, Fort Lupton, LHWD, and MCQWD (Table 3-31).

Those communities with the highest utility rates also are the communities with the highest poverty rates so that their ratio of utility rates to income is also high (Table 3-32). The demographic composition of these communities in the study area may make them especially vulnerable to water rate increases.

Table 3-31. Residential Water Rates as a Percent of Income, 2006.

	Monthly Bill	Annual Water Cost	Median Household Income	Water Bill as % of Household Income
CWCWD	\$35	\$419	\$48,496	0.86%
Eaton	\$30	\$359	\$54,217	0.66%
Erie	\$43	\$514	\$88,365	0.58%
Evans	\$49	\$584	\$42,579	1.37%
FCLWD	\$42	\$502	\$53,126	0.94%
Fort Lupton	\$56	\$724	\$46,887	1.54%
Fort Morgan	\$55	\$658	\$37,975	1.73%
Lafayette	\$42	\$505	\$64,601	0.78%
LHWD	\$76	\$907	\$64,011	1.42%
MCQWD	\$76	\$915	\$39,611	2.31%
Severance	\$31	\$373	\$69,497	0.54%
Windsor	\$49	\$583	\$62,997	0.93%

Source: BBC 2006; U.S. Census 2000; Bureau of Economic Analysis, consumer price index 1999–2005. Average monthly bills were estimated based on current water rates and an average residential water use of 13,000 gallons per month.

In Table 3-32, “Total Water and Wastewater Fees” shows the total costs the communities of Fort Morgan, Evans, and Fort Lupton are currently experiencing for water and wastewater services. To maintain the common affordability benchmark of 2 percent of household income, median household incomes would have to at the levels shown under “Household Income Needed to Afford Fees at Affordability Threshold of 2%.” The “Estimated Percent of Households at or below Needed Income for Affordability” column shows the percent of households in each of those communities that have

household incomes below the needed incomes shown in the previous column. The “Estimated Number of Households Currently Cost Burdened” column provides the number of households referred to in the “Estimated Percent of Households at or Below needed Income for Affordability” column.

3.23 HAZARDOUS SITES

This section presents a summary of the existing hazardous sites within the NISP study area which may be a concern for the proposed project. More

Table 3-32. Estimated Number of Cost-Burdened Households, 2006.

	Total Water and Wastewater Fees	Household Income Needed to Afford Fees at Affordability Threshold of 2%	Estimated Percent of Households at or Below needed Income for Affordability	Estimated Number of Households Currently Cost Burdened (below Affordability Level)
Fort Morgan	\$658	\$32,900	44%	1,830
Evans	\$584	\$29,200	47%	3,100
Fort Lupton	\$724	\$36,200	40%	1,000
Total in Communities				6,840

Source: U.S. Census 2000.

information is provided in the Hazardous Sites Technical Memorandum (ERO 2006d).

3.23.1 Regulatory Framework

“Hazardous materials” is a generic term that encompasses the range of contaminants within the scope of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and petroleum products. Hazardous materials include hazardous waste regulated under the Resource Conservation and Recovery Act (RCRA). CERCLA, commonly known as Superfund, was enacted by Congress in 1980. This law created a tax on the chemical and petroleum industries and provided broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA established prohibitions and requirements concerning closed and abandoned hazardous waste sites, provided for liability of persons responsible for releases of hazardous waste at these sites, and established a trust fund to provide for cleanup when no responsible party could be identified. The EPA is the lead agency in addressing CERCLA sites.

Passed in 1976, RCRA established the framework for managing both solid and hazardous waste. In 1984, Colorado was authorized by the EPA to administer the hazardous waste management programs in lieu of the federal RCRA program. The laws governing the management of hazardous waste in the State of Colorado are contained in the Colorado Hazardous Waste Regulations.

3.23.2 Regional Issues

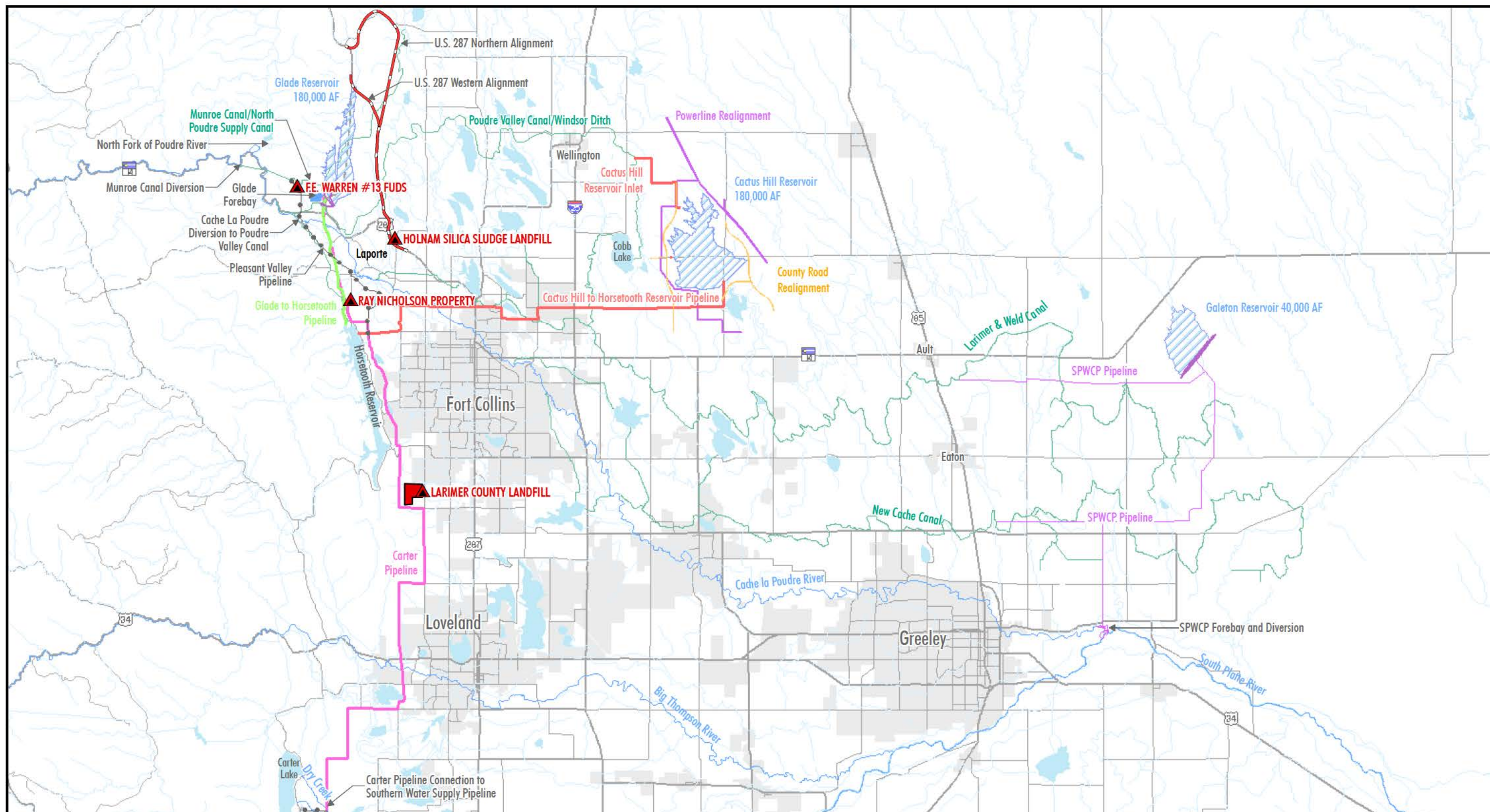
A review of the Colorado Department of Public Health and Environment (CDPHE) database indicates that several hazardous materials sites are known in the region (Table 3-33 and Figure 3-20). Two of these sites occur within or adjacent to proposed facilities.

The proposed realignment of U.S. 287 will be designed to avoid, if possible, the Holcim Mine cement kiln dust landfill and the proposed Glade forebay is located near the Atlas “E” Missile Site 13 (ERO 2006c).

Table 3-33. Known CDPHE Hazardous Sites in the NISP Region.

Facility	Distance / Direction	ID	Address	Facility Type
Larimer County Landfill	0.25 mile east of proposed Carter pipeline route	069-LFL-005	5887 South Taft Hill Road Fort Collins, CO	Landfill
Holnam Silica Sludge Landfill (Holcim Mine)	Adjacent to U.S. 287 Western & Northern Alignment	069-LFL-015	4629 Overland Trail Laporte, CO 80535	Landfill
F.E. Warren #13 FUDS (Former Atlas “E” Missile Site 13)	TCE plume associated with site underlying a portion of Glade Reservoir forebay footprint	COR000204297	6707 McMurray Ranch Road Bellvue, CO 80512	SQG
Ray Nicholson Property	0.25 mile east of proposed Carter pipeline route	COD980951628	2000 North County Road 23 Bellvue, CO 80512	CA

FUDS = Former Used Defense Site, TCE = Trichloroethene, CA = Corrective Action and SQG = Small Quantity Generator.



Prepared by:
ERO

- ▲ Hazardous Materials Site
- Proposed Reservoirs
- Canals
- Major Rivers
- Minor Rivers
- Existing Pipelines

0 10,000 20,000 Feet
1 inch = 20,000 Feet



Figure 3-20
CDPHE Hazardous Sites
In the NISP Region

Prepared for: U.S. Army Corps of Engineers
File: 2701 Haz_materials_assess.mxd (JP)
April 9, 2008

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3.23.3 Glade Reservoir Forebay

The proposed Glade Reservoir forebay (Glade forebay) is part of the District's Proposed Action. The Glade forebay would be located immediately below Glade Dam and constructed to create a reservoir of about 2,000 AF. The purpose of the Glade forebay would be to temporarily store water for pumping into the Glade Reservoir via a pumping station to be located on the southwest corner of the Glade forebay. Water would be supplied to the Glade forebay from the Poudre Valley Canal. The forebay would be created by a combination of excavation and low dam construction using excavated materials. The forebay is planned to be isolated from the ground water table by installation of perimeter slurry walls keyed into unweathered bedrock. Processed alluvium within the area of the forebay along with forebay excavation materials are proposed to be used as borrow materials for dam construction (GEI 2006a).

3.23.3.1 TCE Plume

Trichloroethene (TCE)-contaminated ground water is present beneath the northwest corner of the proposed forebay. The TCE release occurred from operations at the Former Atlas "E" Missile Site 13, located in Laporte, Colorado. The facility was developed in the late 1950s as an intercontinental ballistics missile facility. Operations at the site were phased out by 1965. TCE was used at the site to flush the fuel tanks after missile readiness tests. Waste TCE and residual rocket fuel was dumped into a pit that flowed to a wastewater drainage sump that discharged to the ground surface.

The Corps investigated the TCE-contaminated ground water plume as part of the Remedial Investigation field work conducted in late 2003 and early to mid-2004 to define the vertical and

horizontal extent of the plume (Corps 2004). The following information was reported:

- The primary source of TCE contamination in the ground water appears to be the wastewater drainage sump and outfalls at the Launch and Service Building.
- Four water-bearing zones within the Lyons Formation flow to the southeast toward the Cache la Poudre River.
- The first water-bearing zone is an ephemeral perched zone localized in the northern area of the Missile Site.
- The second water-bearing zone was encountered at an elevation depth of about 5,230 feet (~40 to 50 feet below ground surface (bgs)) in the western and northern portions of the northwest area of the proposed forebay. The second water-bearing zone was encountered at an elevation depth of 5,225 feet (~25 feet bgs) in the southeast corner of the proposed forebay at monitoring well NCWCD and at about 5,218 feet (~30 feet bgs) in the southwest corner of the proposed forebay at monitoring well 13-MW22. Ground water concentrations ranged from nondetect to 74.6 µg/L for TCE within the second water-bearing zone.
- The third water-bearing zone was encountered at an approximate elevation depth of 5,220 feet (~50 feet bgs) in the western portion of the northwest area of the proposed forebay. Ground water concentrations ranged from nondetect to 42.7 µg/L for TCE within the third water-bearing zone.
- TCE contamination was not detected in the fourth water-bearing zone.
- Fracture flow is the controlling factor for all water-bearing zones.
- The second, third, and fourth water-bearing zones are semiconfined and have an upward vertical gradient.
- The TCE contamination is limited to the second and third water-bearing zones and

has not migrated to the Cache la Poudre River or impacted residential wells in the area.

Seasonal monitoring was not performed as part of the Corps Remediation Investigation and, as a result, seasonal fluctuations in TCE concentrations and ground water elevations have not been assessed. Based on methods reported by the Corps, ground water elevation measurements and sampling were not conducted for all wells during one sampling event. Instead, reported ground water elevations and sampling results were either conducted in December 2003, January 2004, or May 2004, and represent data collected over a range of seasonal conditions. Based on regional hydrogeology, ground water elevations are expected to be highest during late spring/early summer and lowest during the winter.

The following conclusions are based on the evaluation of the TCE concentrations reported, location of the TCE plume source area, and the location and depth of the TCE plume in relationship to the proposed forebay:

- TCE concentrations in ground water above the Colorado standard of 5 µg/L have not been detected beneath the proposed forebay within the second or third water-bearing units.
- TCE concentrations in ground water beneath the northwest corner of the proposed forebay are anticipated to be just below the Colorado standard.
- TCE-contaminated soil above Colorado standards is not expected in the proposed excavated unsaturated soil material within the footprint of the forebay.
- Ground water from the second water-bearing unit is expected to be encountered during excavation activities within the southern half of the forebay.

Although TCE contaminated ground water above the Colorado standards is not anticipated, potential seasonal variations in TCE concentrations and ground water depth were not evaluated during the Corps' site characterization and as a result, the exact TCE concentration and depth of ground water within the proposed forebay is unknown. The proposed forebay location and depth is subject to change based on potential pilot boreholes and initial excavation activities.

More detailed information on the TCE plume and forebay are presented in Corps (2004), GEI (2006a), and ERO (2006c).

3.24 NOISE

In the Glade Reservoir site, U.S. 287 is an existing source of noise. Most of the remainder of the Glade Reservoir site is in a rural area and currently does not have high noise levels. The Galeton and Cactus Hill Reservoir sites are in rural areas, and are in or near County Roads, where there are not high noise levels. The proposed U.S. 287 realignment alternatives would travel through the abandoned Holcim Mine, and would travel along portions of existing U.S. 287. The abandoned Holcim Mine does not have high noise levels.

3.25 AIR QUALITY

The Glade, Galeton, and Cactus Hill reservoir sites and the existing and proposed U.S. 287 are in rural areas. As of November 20, 2007, the areas in the vicinity of the proposed Glade and Galeton reservoirs have been designated as nonattainment areas for ozone. However, air quality is currently not an issue in these areas.

3.26 ENERGY USE

NISP does not currently use any energy. Projected energy uses associated with NISP are discussed in Chapter 4.

3.27 U.S. 287—SUMMARY OF AFFECTED ENVIRONMENT

The following sections pertain to the U.S. 287 study area. CDOT, a cooperating agency for this EIS, has specific requirements for fulfilling NEPA requirements that tend to focus on specific resources frequently associated with highway construction (e.g., noise, air quality, traffic and paleontology). The following resources and issues are not discussed in this section: surface water resources and quality, water rights, fish and aquatic life, recreation, visual quality, and hazardous materials. The water, aquatic life, and recreation issues have little significance for the proposed U.S. 287 realignments. Land use, hazardous materials, and visual resources are presented earlier in Chapter 3 in a regional context.

3.27.1 U.S. 287 Realignment Study Area

Two realignment alternatives for U.S. 287 are proposed (Figure 3-19). Both potential realignments would follow a common route for about 4 miles in the south beginning at the existing U.S. 287 and proceeding north through the decommissioned Holcim Mine, which occurs on a shale/limestone ridge and consists mostly of spoil piles. At the north end of the Holcim Mine, the two proposed realignments would diverge into a western and northern alignment. The western realignment alternative would cross two valleys supporting a mix of native and introduced grasslands with several large meadows divided by a north/south trending

hogback covered with shrublands and grasslands. The western alignment would join existing U.S. 287 just north of the proposed Glade Reservoir. The northern realignment alternative would extend north of the Holcim Mine across a landscape similar to the western realignment. At Owl Canyon Road the realignment would approximately follow the existing Owl Canyon Road alignment to U.S. 287. Two large canals, the North Poudre Supply Canal and the Poudre Valley Canal, meander from southwest to northeast across the U.S. 287 realignment study area.

3.27.2 Geology

Geology within the vicinity of the U.S. 287 realignment study area is similar to that in the general vicinity of the Glade Reservoir study area. Paleozoic to Mesozoic sedimentary rock units, subjected to uplift, folding, faulting, and erosion from Laramide time through late Pliocene time, have resulted in sedimentary strata that is uplifted and generally tilting east. Based on the geologic mapping of Braddock et al. (1988a, 1988b), the U.S. 287 realignment study area contains the following geologic units, from stratigraphically lowest to highest: the Upper Permian and Lower Triassic Lykins Formation, undivided Upper Triassic Jelm Formation and Upper and Middle Jurassic Sundance Formation, Upper Jurassic Morrison Formation, Lower Cretaceous Dakota Group (South Platte and Lytle Formations), Lower Cretaceous Benton Group (Carlile Shale, Greenhorn Limestone, Graneros Shale, Mowry Shale), and Upper Cretaceous Niobrara Formation (Smoky Hill Shale Member, Fort Hays Limestone Member) (RMP 2006).

3.27.2.1 Lykins Formation

In the vicinity of the U.S. 287 study area, the Late Permian and Early Triassic Lykins Formations are

composed of red and reddish-brown siltstone and fine-grained sandstone containing several carbonate beds (Braddock et al. 1988a, 1988b; RMP 2006). The Lykins Formation was deposited in shallow marine and tidal flat environments.

3.27.2.2 *Undivided Jelm and Sundance Formations*

The Red Draw Member of the Jelm Formation is composed of orange-pink and reddish-brown, cross-bedded, fine-grained calcareous sandstone. The Jelm Formation was deposited on a fluvial-deltaic plain. The stratigraphically overlying Sundance Formation is composed of orange-pink and reddish-brown, fine- to medium-grained, cross-bedded, calcareous sandstone; massive- to tabular-bedded, fine-grained, gray to white sandstone; and flat-bedded, light gray, fine-grained sandstone and gray clay shale (Braddock et al. 1988a, 1988b; RMP 2006). The Sundance Formation was deposited in a range of shallow marine and nearshore (tidal inlet, back-barrier shoal, and sandy tidal-flats) environments.

3.27.2.3 *Morrison Formation*

The widely distributed and highly fossiliferous Upper Jurassic Morrison Formation is composed of variegated red, green, and gray mudstone and claystone, with tan sandstone (Braddock et al. 1988a, 1988b; Bryant et al. 1981); and was deposited in a combination of fluvial (stream) and lacustrine (lake) environments (Peterson 1972).

The Lower Cretaceous Dakota Group overlies the Morrison Formation. The Dakota group was deposited in the western interior seaway across a cyclical sequence of depositional environments that included marginal marine, coastal plain, and fluvial-lacustrine. It has been subdivided into the basal Lytle Formation and the overlying South Platte Formation (RMP 2006).

3.27.2.4 *Benton Group*

The Upper Cretaceous Benton Group (also referred to as the Benton Shale) has been subdivided, from stratigraphically lowest to highest, into the Mowry Shale, Graneros Shale, Greenhorn Limestone, and Carlile Shale. The Mowry Shale consists of white-weathering siliceous shale. The Graneros Shale consists of dark gray to grayish-black siltstone and claystone. The Greenhorn Limestone consists of interbedded dark-gray limestone and olive gray calcareous silty claystone and siltstone. The Carlile Shale consists of olive gray silty claystone and sandy siltstone (Braddock et al. 1988a, 1988b). These rocks were deposited predominantly in a nearshore marine environment.

3.27.2.5 *Niobrara Formation*

The widely distributed Niobrara Formation, which has been subdivided into the Fort Hays Limestone Member and the overlying Smoky Hill Shale Member, was deposited predominantly in nearshore marine settings.

3.27.3 Paleontology

3.27.3.1 *Regulatory Framework*

Fossils are classified as nonrenewable scientific resources and are protected by various laws, ordinances, regulations, and standards across the country. Professional standards for the assessment and mitigation of adverse impacts to paleontological resources have been established by the Society of Vertebrate Paleontology (SVP) (1995). The Colorado Historical, Prehistorical, and Archaeological Resources Act of 1973 (C.R.S. 24-80-401 to 411, and 24-80-1301 to 1305) defines permitting requirements and procedures for the collection of prehistoric resources, including paleontological resources, on state lands, and actions

that should be taken in the event that resources are discovered in the course of state-funded projects and on state-owned/administered lands. Based on this legislation, CDOT requests assessments on state-owned and/or administered lands that have the potential to contain significant paleontological resources, and monitoring/mitigation during ground disturbance in these areas. A paleontological assessment was requested by CDOT because CDOT is a cooperating agency for NISP and must fulfill its NEPA requirements. CDOT owns the current ROW for U.S. 287 proposed for abandonment, and will own the ROW for the proposed realignment for U.S. 287.

3.27.3.2 Existing Paleontological Resources

The paleontological resources assessment was an evaluation of potential impacts on scientifically significant nonrenewable paleontological resources that could result from construction-related ground disturbance within the APE for the proposed U.S. 287 realignment alternatives associated with NISP. The scope of the study included a review of relevant scientific literature, geologic maps, and museum records. The museums included in the record search were the University of Colorado Museum, and the

Denver Museum of Nature and Science. The paleontological evaluation procedures were conducted in accordance with SVP (1995) guidelines by qualified and permitted paleontologists (State of Colorado Paleontological Permit 2006-5).

The paleontological sensitivities of the geologic units within the APE for the U.S. 287 western and northern realignment alternatives associated with NISP were evaluated by reviewing scientific and technical literature, geologic mapping, and museum records. Based on the geologic mapping of Braddock et al. (1988a, 1988b), the study area contains six bedrock geologic units ranging in age from Permian to Cretaceous (previously described in the Geology section). All of these units are known to contain fossils of various taxonomic affinities and abundances across their distribution.

The paleontological sensitivities of each geologic unit within the APE for the western realignment alternative were evaluated using the Probable Fossil Yield Classification system (PFYC) developed by the U.S. Forest Service (1996) (Table 3-34). For this study, the PFYC has been modified to explicitly include fossil plants:

- *Class 1:* Igneous and metamorphic geologic units (excluding tuffs) not likely to contain

Table 3-34. Summarized Paleontological Sensitivities of Geologic Units for the U.S. 287 Western Alternative using the PFYC System.

Geologic Unit	Age	Typical Fossils	PFYC
Niobrara Formation	Late Cretaceous	Locally abundant marine invertebrates, less common terrestrial and marine vertebrates (especially Smoky Hill Chalk Member)	<i>Class 3</i>
Benton Group	Late Cretaceous	Scarce vertebrates (marine reptiles and fish), locally abundant marine invertebrates	<i>Class 3</i>
Dakota Group	Early Cretaceous	Scarce vertebrates, locally common marine invertebrates, terrestrial plants, and trace fossils	<i>Class 3</i>
Morrison Formation	Late Jurassic	Locally common terrestrial vertebrates (especially dinosaurs), invertebrates, plants, and trace fossils	<i>Class 5</i>
Undivided Sundance and Jelm Formations	Late Triassic (Jelm), Middle and Late Jurassic (Sundance)	Sundance: Marine vertebrates and invertebrates. Jelm: scarce fossils including bone fragments and wood	<i>Class 3</i>
Lykins Formation	Late Permian to Early Triassic	Stromatolites	<i>Class 2</i>

recognizable fossil remains. Ground-disturbing activities will not require mitigation except in rare circumstances.

- *Class 2:* Sedimentary geologic units not likely to contain vertebrate fossils or scientifically significant invertebrate (or plant) fossils. Ground-disturbing activities are not likely to require mitigation.
- *Class 3:* Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence. Ground-disturbing activities will require sufficient mitigation to determine whether significant paleontological resources occur in the area of a proposed action. Mitigation beyond initial findings will range from no further action necessary to full and continuous monitoring of significant localities during the action.
- *Class 4:* Class 4 geologic units are Class 5 units that have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation. Proposed ground-disturbing activities will require assessment to determine whether significant paleontological resources occur in the area of a proposed action and whether the action will impact the resources. Mitigation beyond initial findings will range from no further mitigation necessary to full and continuous monitoring of significant

localities during the action. This classification will often not be applied until after on-the-ground assessments are made.

- *Class 5:* Highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant invertebrate (or plant) fossils, and that are at high risk of natural degradation and/or human-caused adverse impacts. These areas are likely to be poached. Mitigation of ground-disturbing activities is required and may be intense. Areas of special interest and concern should be designated and intensely managed.

At least four previously recorded fossil localities occur within or near the APE for the U.S. 287 western and northern alignment alternatives (Table 3-35). In addition to these four localities, numerous other fossil localities have been recorded in the same geologic units elsewhere in Colorado and in adjacent states.

The southernmost approximate 4 miles of the western realignment alternative is underlain by rocks of the Smoky Hill Shale and Fort Hays Limestone Members of the Niobrara Formation. This area has been strip-mined and reclaimed by the Holcim Mine. Thus, most of the surface rocks and contained fossils in this area have been removed from their original

Table 3-35. Previously Recorded Fossil Localities from within and nearby the NISP Study Area.

Locality#	Institution ¹	Locality Name	Formation	Age	Fossils
86050	UCM	North of Fort Collins	Morrison	Late Jurassic	Dinosaur bones (theropod tooth and vertebrae) and freshwater sponges
87092	UCM	Ideal Shark	Niobrara Formation – Smoky Hill Shale Member	Late Cretaceous	Sharks teeth
88015	UCM	Jeff's No Excitement Clam Locality	Dakota Group	Early Cretaceous	Inoceramid clams
none	Waage, 1955	n/a	Dakota Group	Early Cretaceous	Plesiosaur Vertebrae

¹UCM = University of Colorado Museum of Natural History.

Table 3-36. Fossil Localities Discovered within the Field Survey for the Western U.S. 287 Realignment Alternative.

Field Locality#	Lithology	Formation	Fossils
DD012306-01	Interbedded bluish-gray shale and limestone which weathers to orange-tan	Niobrara – Smoky Hill Shale	Inoceramid clam shells and molds on exposed rock face
DD041606-01	Blocky tan sandstone	Lytle Formation – Dakota Group	Wood and plant impressions (stems, palm fronds) on boulder
DD041606-02	Interbedded dark gray fine-grained sandstone and shale	Middle shale member, South Platte Formation – Dakota Group	Inoceramid clam shells, baculite shell, trace fossils (indeterminate burrows)

stratigraphic context. However, some *in situ* strata do remain, and fossils were present on exposed rocks throughout the area. The northernmost 2 miles of the western alternative bends to the northwest and crosses rocks of the Benton Group, Dakota Group (which forms a double ridge), Morrison Formation, Jelm and Sundance Formations, and Lykins Formation before rejoining the existing U.S. 287 alignment.

Three fossil localities were recorded during the field survey of the western alternative (Table 3-36). Observed fossils occurred mostly on weathered rock exposures, and included shells and molds of unidentified inoceramid clams in the Smoky Hill Shale Member of the Niobrara Formation; plants including stem impressions, a partial palm frond and other unidentifiable fragments in the Lytle Formation; and inoceramid clam shells and molds, a weathered mold of a partial baculite, and unidentified invertebrate burrows in the South Platte Formation.

More detailed information on the paleontological resources of the proposed realignment alternatives is presented in the Paleontological Technical Report (RMP 2006).

3.27.4 Soils

Soils in the U.S. 287 realignment study area include Santana loam and Harlan fine sandy loam in the Owl Canyon area; Hilly haplustolls, Baller complex, Purner fine sandy loam, Laporte rock outcrop and rock outcrop on the hogbacks and ridges; and Kim loam, Minnequa silty loam, and Renohill clay loam; and Caruso clay loam in the valley east of the hogback.

Soils on the hogbacks generally are Baller complex Purner fine sandy loams, hilly haplustolls, Laporte rock outcrops, and rock outcrops. Purner fine sandy loams are well-drained soils formed in material weathered from reddish brown sandstone. Hilly haplustolls occur on mountainsides and fans, and have extremely variable soil texture, ranging from sandy loam to loam to clay loam. The haplustolls and Purner fine sandy loams include areas of rock outcrops. Baller complex soils occur on sloping ridges and hogbacks, are well drained, and formed from weathered sandstone and shale. Laporte rock outcrops occur on gentle slopes to steep ridges, and include deep, well-drained loams formed from weathered limestone. Rock outcrops form a large portion of the Laporte rock outcrop soil type.

Soils in the Owl Canyon area are Santana loam, Poudre fine sandy loam, Harlan fine sandy loam, and Heldt clay loam. The Santana loam is deep and well

drained, and is formed from mixed alluvium and colluvium. The Poudre fine sandy loam consists of deep, somewhat poorly drained soils that formed in alluvium on terraces, floodplains, and drainageways. The Harlan fine sandy loam occurs on terraces, fans, and valleysides, and consists of deep, well-drained soils that formed from weathered alluvium, sandstone, and shale. Soil texture ranges from fine sandy loam to loam to sandy clay loam. Heldt clay loam is a deep, well-drained soil that formed in alluvium from clay shale. Soil texture ranges from clay loam to silty clay loam.

Soils east of the hogback and in unmined areas of the Holcim Mine are Kim loam, Minnequa silty loam, Renohill clay loam, and Caruso clay loam. Kim loam is a deep, well-drained soil formed from mixed colluvium. Minnequa silty loam is a well-drained soil on moderately steep slopes, formed from weathered limestone. Renohill clay loam is a moderately deep, well-drained soil formed from weathered sandstone. Caruso clay loam is a deep, somewhat poorly drained soil formed from mixed alluvium that has formed on low terraces and bottom lands.

NRCS soil mapping units in the U.S. 287 realignment study area identified as potential Prime Farmland soils if irrigated are Santana loam, Kim loam, Heldt clay loam, Caruso clay loam, and Harlan fine sandy loam. No potential Prime Farmlands if not irrigated, were mapped in the U.S. 287 realignment study area.

3.27.5 Wetlands and Other Waters

3.27.5.1.1 Wetlands

Wetlands in the U.S. 287 realignment study area occur in depressions, in drainage swales, and along intermittent and ephemeral creeks. Also, wetlands occur along portions of the Poudre Valley Canal, although these wetlands may be disturbed or

removed from time to time as part of maintenance on the canal.

Most of the wetlands in the U.S. 287 realignment study area are palustrine persistent emergent wetlands, dominated by species such as meadow foxtail, switchgrass, spikerush, Baltic rush, threesquare, and various sedges. Soils range in texture from clay to clay loam to silt loam (Table 3-37). Indicators of wetland hydrology include soil saturation and/or inundation.

Palustrine scrub-shrub wetlands occur in two small drainages, Spring Creek and near the Munroe Canal, in the study area. These wetlands are mostly patches of sandbar willow with an understory of Canada thistle, foxtail barley, Baltic rush, and other herbaceous species.

3.27.5.1.2 Wetland Functions and Values

Wetland functions and values in the U.S. 287 realignment study area were assessed for three HGM wetland classification types: riverine, palustrine persistent emergent wetlands, riverine palustrine scrub-shrub, and depressional palustrine persistent emergent wetlands. The riverine palustrine persistent emergent wetlands rated low to moderate for all functions (except one wetland, which rated high for ground water discharge because it contains ground water seeps), generally because of small size and because the drainages have ephemeral hydrologic regimes (ERO 2008b).

Riverine palustrine scrub-shrub wetlands along Spring Creek had the greatest number of high functions, including general wildlife, sediment shoreline stabilization, production export food chain support, and ground water discharge because of the presence of a spring.

Depressional palustrine persistent emergent wetlands rated low for all functions except sediment/nutrient/toxicant removal (moderate). The low

Table 3-37. Wetlands and Other Waters, U.S. 287 Study Area.

Wetlands¹	Cowardin Type	HGM Type	Western Alignment Area (Acres)	Northern Alignment Area (Acres)
Wetland 9	Palustrine persistent emergent	Depressional	0.1	
Wetland 10	Palustrine scrub-shrub	Riverine	0.2	
Wetland 11	Palustrine persistent emergent	Depressional	4.2	4.2
Wetland 12	Palustrine persistent emergent	Riverine	1.8	
Wetland 12a	Palustrine persistent emergent	Riverine	2.2	1.7
Wetland 12b	Palustrine persistent emergent	Riverine	1.5	3.0
Wetland 13	Palustrine persistent emergent	Depressional	1.2	1.2
Wetland 14	Palustrine persistent emergent	Riverine	0.2	0.2
Wetland 15	Palustrine persistent emergent	Riverine	0.1	0.1
Wetland 16	Palustrine persistent emergent	Riverine	0.1	0.1
Wetland 17	Palustrine persistent emergent	Depressional	1.8	1.8
Wetland 18	Palustrine persistent emergent	Riverine	<0.1	<0.1
Wetland 19	Palustrine persistent emergent	Riverine	0.4	0.4
Wetland 20	Palustrine persistent emergent	Riverine	0.3	0.3
Wetland 21	Palustrine persistent emergent	Riverine	2.7	2.7
Wetland 22	Palustrine persistent scrub-shrub	Riverine	9.6	9.6
Wetland 23	Palustrine persistent emergent	Riverine	2.0	2.0
Wetland 24	Palustrine scrub-shrub			23.3
Wetland 25	Palustrine emergent			0.6
Wetland 26	Palustrine emergent			2.7
Total Wetlands			28.4	53.9
Other Waters			Area (Acres)	Area (Acres)
Stock and irrigation ponds			12.9	12.9
Creeks, streams, ditches, and canals			24.6	14.1
Total Other Waters			37.5	27.0

¹A determination has not been made regarding the jurisdictional status of these wetlands and other waters under the CWA.

ratings are related to ephemeral hydrologic regime, small size, and low vegetation type diversity.

3.27.6 Riparian Resources

In the U.S. 287 realignment study area, riparian areas occur along ephemeral and intermittent

channels. The mesic native shrubland vegetation cover type is the most common riparian vegetation cover type, with two areas of mesic mixed woodlands, and one small area of mesic mixed shrublands.

3.27.7 Wildlife

The U.S. 287 realignment study area comprises a combination of wetland, riparian, and grassland habitats. In addition, several reclaimed limestone quarries provide open water habitat for waterfowl, shorebirds, amphibians, and other wildlife.

Riparian areas provide nesting and foraging habitat, as well as hiding and thermal cover, for raptors, songbirds, and mammals. Several potential raptor nests were observed in the U.S. 287 realignment study area, mostly in large cottonwoods directly east of the mined area.

Mule deer and elk highway crossing areas are along the existing U.S. 287 within the U.S. 287 realignment study area (Figure 3-15). Pronghorn were observed in the northern portion of the U.S. 287 realignment study area (ERO 2008d).

Northern leopard frog and Woodhouse's toad tadpoles were observed in the U.S. 287 realignment study area.

3.27.8 Species of Concern

3.27.8.1 *Federally Listed Threatened, Endangered, and Candidate Species*

3.27.8.1.1 *Black-footed Ferret*

Two prairie dog colonies occur in the western side of the U.S. 287 realignment study area (Figure 3-16). The prairie dog colonies in the U.S. 287 realignment study area are smaller than 80 acres, and thus unlikely to support the black-footed ferret.

3.27.8.1.2 *Preble's Meadow Jumping Mouse*

Access to areas along the Owl Canyon Road was limited. However, these areas were evaluated from the roadside for potential Preble's habitat. Although intermittent, the drainage through Owl Canyon could provide potential Preble's habitat. Other drainages containing wetlands in the U.S. 287 realignment

study area are intermittent and do not contain the multi-layered shrub habitat that Preble's typically favor. A Preble's habitat assessment was submitted to the Service for the U.S. 287 Western Realignment requesting concurrence that this area is not likely to support Preble's (ERO 2006b). ERO has requested a written concurrence that areas potentially impacted by this alignment are not likely to support a population of Preble's. The Service has concurred that areas potentially impacted by this alignment are not likely to support a population of Preble's (Service 2008).

3.27.8.1.3 *Bald Eagle*

Bald eagle winter range occurs northeast of the U.S. 287 study area. No bald eagle nest sites or roosts are known to occur in the vicinity of this study area.

3.27.8.1.4 *Colorado Butterfly Plant*

The valley west of the Holcim Mine does not show evidence of an active floodplain and, therefore, does not appear to have habitat for CBP. The small drainages east of the Holcim Mine have very narrow floodplains and, thus, habitat for CBP is limited. No CBP was found during surveys conducted at the U.S. 287 study area (ERO 2008d). A CBP survey and habitat assessment report was submitted to the Service for the U.S. 287 Western Realignment. Although no CBP were found during the surveys, the Service requested that all areas with suitable habitat be surveyed 2 years prior to construction (Service 2007; Mayo 2007).

3.27.8.1.5 *Ute Ladies'-tresses Orchid*

Potential habitat along the tributaries within the U.S. 287 realignment study area were surveyed for ULTO; no ULTO were found. A ULTO survey and habitat assessment report was submitted to the Service for the U.S. 287 Western Realignment. Although no ULTO were found during the survey, the Service requested that all areas with suitable habitat be surveyed for 2 years prior to construction.

3.27.8.2 State Species of Concern

Two prairie dog colonies occur in the western side of the U.S. 287 realignment study area (Figure 3-16). The northern end of the U.S. 287 realignment study area is designated as swift fox overall range (CNDIS 2006), although home ranges are limited by the existing U.S. 287. Habitat for the common gartersnake and northern leopard frog occurs along wetlands and drainages in the U.S. 287 realignment study area, and tadpoles identified as probable northern leopard frog tadpoles were observed in wetlands and open waters on the western side of Holcim Mine. During field surveys, large populations of thousands of individual Bell's twinpods were found on the Holcim Mine and the undisturbed ridges to the east of the Holcim Mine.

3.27.9 Cultural Resources

The file searches conducted for the Glade Reservoir alternative found that nine sites have been identified

either in or in close proximity to the two U.S. 287 realignment alternatives and the proposed abandonment of a portion of the current U.S. 287 ROW (Table 3-38). Two of the nine resources have been determined eligible by SHPO and one is recommended field eligible. Three other sites are recommended field not eligible and three have not been assessed. The two determined eligible sites are irrigation ditches that will be crossed by the realignment alternatives or the portion of U.S. 287 proposed for abandonment. The third site is a prehistoric stone circle site that is in the proximity of the western realignment.

Seven unrecorded sites also are present either in or in close proximity to the two U.S. 287 realignment alternatives or the existing segment of U.S. 287 proposed for abandonment (Table 3-39). The unrecorded sites include five linear resources that cross the realignment alternatives or existing segment of U.S. 287 proposed for abandonment. Two of the linear resources are railroad related, and

Table 3-38. Recorded Cultural Resources for Existing U.S. 287 and Realignment Alternatives.

Site Number	Site Name	Site Type	Description	Significance	Alternative or Action
5LR304	Unnamed	Prehistoric Archaeological	Open Lithic Scatter	No Assessment Given	Proximity of Preferred Alignment
5LR305	Unnamed	Prehistoric Archaeological	Open Lithic Scatter	No Assessment Given	Proximity of Preferred Alignment
5LR772	Coombs Ranch/Ingleside Quarry	Historic Archaeological	Agricultural Complex	No Assessment Given	Proximity of Existing Route and Preferred Alignment
5LR962	Dry Creek Ditch	Historic Engineering	Irrigation Ditch	Not Eligible; Field Assessment	Crossed by Both Alignments
5LR963	Falloon Place	Historic Archaeological	Agricultural Complex	Not Eligible; Field Assessment	Proximity of Existing Route
5LR965	Willow Nook	Historic Archaeological	Residential Complex	Not Eligible; Field Assessment	Proximity of Existing Route
5LR1692	Yelek Site	Prehistoric Archaeological	Stone Circles	Eligible; Field Assessment	Proximity of Preferred Alignment
5LR9649	Poudre Valley Canal	Historic Engineering	Canal	Eligible; Official Assessment	Crossed by Both Proposed Alignments and the Existing Route
5LR9930	Unnamed	Historic Engineering	Irrigation Ditch	Eligible; Official Assessment	Crossed by Preferred Alignment

Table 3-39. Unrecorded Cultural Resource Sites or Segments of Linear Sites.

Resource Name	Alternative or Action
North Poudre Supply Canal	Crossed by Both Proposed Alignments and the Existing Route
Colorado & Southern Railroad Abandoned ROW and Roadbed ¹	Crossed by Both Proposed Alignments and in the Proximity of the Existing Route
Union Pacific Railroad ¹	Proximity and Possible Crossing by Both Proposed Alignments
Holcim Mine	Crossed by Both Proposed Alignments
Unnamed Irrigation Ditches	Crossed by Both Proposed Alignments and the Existing Route
Rock Shelter Site	Preferred Alignment
Historic Quarry Site	Preferred Alignment

¹Other Larimer County segments of these linear resources have been determined eligible by SHPO.

other segments of the same railroads in Larimer County have been determined eligible by SHPO. The other two are irrigation ditches of which one, the North Poudre Supply Canal, is likely to be determined eligible as it compares favorably to other ditches in the region that have been determined eligible by SHPO. The other unrecorded sites include the Holcim Mine, a historic stone quarry and a rock shelter site. It is likely that the Holcim Mine would be determined eligible for its association with basic mineral mining in Colorado and for association with early 20th century business leaders such as Charles Boettcher.

3.27.10 Noise

The potential effect of the proposed realignment of U.S. 287 on noise was examined for both the northern and western proposed U.S. 287 realignment alternatives (MERC0 2006a). The noise study validated whether the Traffic Noise Model (TNM) predictions were valid, and considered and evaluated human hearing sensitivity, how outdoor sound propagates, site observations, and the TNM results. Noise levels (defined as unwanted sound for purposes of this study) near highways depend on traffic volume; speed of the traffic; mixture of cars, light trucks, and heavy trucks in the flow of traffic;

distance between noise produced on the highway and receptors; intervening topography; atmospheric conditions; and highway composition (MERC0 2006a).

Noise is measured according to pressure vibrations on the decibel scale (dB), which is logarithmic. For highway traffic noise, an adjustment, or weighting of the high- and low-pitched sounds is made to approximate the way that an average person hears sounds (Figure 3-21). The adjusted sounds are called “A-weighted levels” (dBA) (MERC0 2006a).

Vehicle noise is a combination of the noises produced by engines, exhaust, and tires. Noise levels are affected by the distance of the receptor (such as a human or a neighborhood) from the noise, the terrain, vegetation, and natural and manmade obstacles. Heavier traffic volumes, higher speeds, greater numbers of trucks, defective equipment, and inclines may increase traffic noise levels. The significant factors that contribute to outdoor sound propagation from source to the receiver can be described by seven main mechanisms. These mechanisms include: atmospheric absorption, ground reflection, barrier insertion loss, building attenuation, heavily wooded area attenuation, amplification caused by urban reverberation, and effects of vertical wind/temperature gradients (MERC0 2006a).

For highway projects that require noise analyses in Colorado, the accepted noise descriptor is the worst-hour Leq(h) for determining existing and future noise levels and impacts. The “worst-hour” reflects the conditions that will produce the worst traffic noise. In general, this is highest traffic volume traveling at the highest possible speed and reflects Level of Service conditions. If traffic volume continues to increase past these conditions, the traffic is forced to slow down, which in turn decreases the noise levels generated (MERCO 2006a).

To help control noise and maintain an aesthetic environment, CDOT established Noise Abatement Criteria (Table 3-40). The primary consideration is normally residential areas; however, frequent human use areas such as schools, parks, hotels, and commercial centers are also considered for evaluation. Most sensitive receivers that will be encountered on highway traffic noise analysis efforts will be categorized as category “B” receivers and are subject to the 66 dBA criterion.

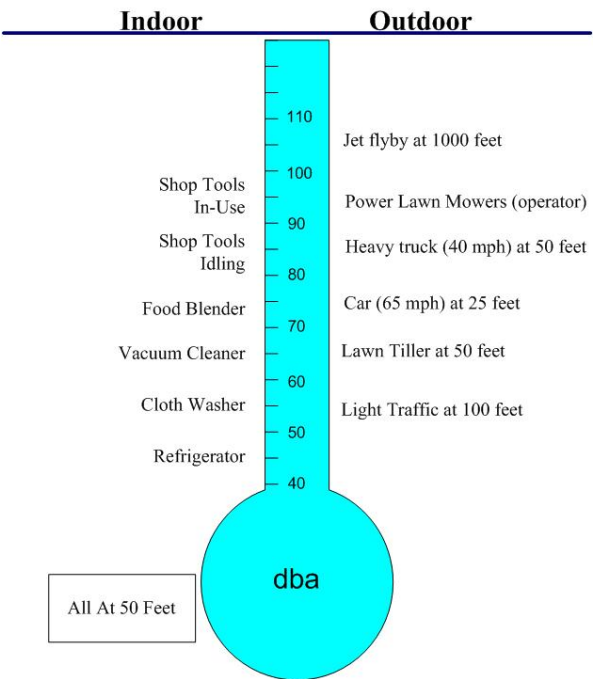
3.27.10.1 Regulatory Framework

3.27.10.1.1 Federal Noise Control Act and Implementing Regulations

The Noise Control Act of 1972 (42 U.S.C. 4901 et seq.) authorized the establishment of federal noise emission standards. Companion legislation (23 U.S.C. 109(i)) directs the Secretary of Transportation to develop and implement traffic noise standards for highway projects.

Noise impact criteria and abatement are set forth in 23 CFR Part 772 (Procedures for Abatement of Highway Traffic Noise and Construction Noise). This regulation requires preparing a noise study to determine what noise impacts, if any, will result from the proposed highway improvement and what measures will be taken to lessen these impacts. If noise impacts are expected, noise-reduction

Figure 3-21. Typical Average A-weighted Sound Levels for Commonly Encountered Noises.



measures that are determined by the state highway agency to be practicable, reasonable, and acceptable to the public must be incorporated into the highway improvements.

3.27.10.1.2 State Noise Legislation and Implementing Regulations

According to CDOT Policy Directive 1601, any project that includes state, local, and public-private partnership projects overseen by CDOT must comply with all the federal regulatory requirements. A noise analysis study is required for a Type 1 project if noise-sensitive receivers are present within the project study zone. The study zone is defined as a 500-foot distance in all directions from the edge of traveled way through the project.

CDOT provides requirements to evaluate highway traffic noise and what must be considered to mitigate noise impacts during the planning, design, and

Table 3-40. CDOT Noise Abatement Criteria.

Activity Category	CDOT Leq (h), dBA ¹	Description of Activity Category
A	56 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where preservation of those qualities is essential if the area is to continue to serve its intended purpose
B	66 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals
C	71 (Exterior)	Developed lands, properties, or activities not included in Category A or B
D	--	Undeveloped lands
E	51 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums

¹Hourly A-Weighted sound level in decibels, reflecting a 1 dBA “Approach” value below 23 CFR Part 772 values.

construction of highways and transportation improvements. 23 CFR Part 772 mandates that a traffic noise analysis is required by law for federally funded projects, and required by state policy for other funded projects that: (1) involve construction of a new highway, (2) significantly change the horizontal or vertical alignment of an existing highway, or (3) increase the number of through traffic lanes on an existing highway. Relocation of U.S. 287 is such a Type I project.

A noise-sensitive receiver is any location where a traffic noise impact may be detrimental to the enjoyment and functional use of the property. The primary consideration is normally residential areas but also includes schools, parks, hotels, and commercial centers. A traffic noise impact is considered to occur when any noise-sensitive receiver is subjected to either: 1) existing or future noise levels that approach or exceed the noise abatement criteria; or 2) future noise levels that substantially exceed the existing noise levels. A substantial increase over existing noise levels is considered by CDOT to be an increase over existing noise levels of at least 10 dBA.

3.27.10.2 Noise Levels in the U.S. 287 Realignment Corridors

CDOT 2005 traffic volumes for U.S. 287 were used to generate 2005 noise modeling for the proposed northern and western U.S. 287 realignment alternatives. For purposes of the noise analysis, three segments were analyzed. Segment “C” is the southern portion of the proposed U.S. 287 realignment, and travels through the Holcim Mine area that is common to both proposed realignments. Segment “F” (the western realignment) travels over the hogback to join existing U.S. 287. Segment “J” (the northern realignment) travels north from the Holcim Mine through Owl Canyon before joining existing U.S. 287.

A 500-foot-wide area was examined along both sides of the centerline for both the western and northern alignments, including the portion where the alignments are the same. No residences (or human habitat) are located within 500 feet of either centerline. The closest residence to a U.S. 287 realignment alternative is along the northern alignment near Owl Canyon. Because no residences were present during the noise analysis, noise-receptor points were established along both alignments for noise level modeling. To

Table 3-41. Residence Distance from U.S. 287 Realignment Alternatives.

Number of Residences within 500 to 1,500 Feet from the Highway Centerline	Number of Residences within 1,500 to 3,000 Feet from the Highway Centerline	Segment
2	24	West of segment "C"
0	3	East of segment "C"
0	2	West of segment "F"
0	0	East of segment "F"
0	0	West of segment "J"
9	2	East of segment "J"

conservatively estimate the number of residences that could be affected by noise associated with the U.S. 287 realignment, the number of residences within 3,000 feet of the proposed U.S. 287 realignments were calculated (Table 3-41). The background noise values for the realignment corridors (based on a nearby segment of highway) were estimated to be 44.2 dBA.

3.27.11 Air Quality

CDOT has requested a qualitative analysis of air quality for the U.S. 287 realignment study area. The following is a brief summary of regulatory requirements and existing conditions for air quality in the U.S. 287 realignment study area. More detailed information on air quality is presented in the Air Quality Technical Report (MERC0 2006b).

3.27.11.1 Regulatory Framework

3.27.11.1.1 State Implementation Plans and Air Quality Conformity

Section 176(c) of the Clean Air Act and related requirements mandate that federally related transportation plans, programs, and projects must demonstrate and assure air quality conformity for noncompliance or redesignated attainment areas (i.e., maintenance plan). An air quality conformity determination is required for all nonexempt projects

within or affecting a nonattainment or maintenance area for criteria pollutants as established in the National Ambient Air Quality Standards (NAAQS). The U.S. 287 realignment study area is located outside of the Fort Collins and Larimer County attainment/maintenance area. Therefore, the conformity provisions of the federal Clean Air Act do not apply.

3.27.11.1.2 Clean Air Act (CAA)

The Clean Air Act of 1970, 42 U.S.C. 7401 et seq., was enacted to protect and enhance air quality and to assist state and local governments with air pollution prevention programs. The Clean Air Act is also the basis for the NAAQS, Prevention of Significant Deterioration, State Implementation Plan, and Conformity regulations.

The CAA requires the EPA to identify and publish a list of common air pollutants that could endanger public health or welfare. The EPA must also establish NAAQS for each of the "criteria pollutants," above which public health or welfare would be endangered.

The statute and A Plain English Guide to the Clean Air Act are online at the EPA's home page. http://www.epa.gov/air/oaq_caa.html/.

3.27.11.1.3 Clean Air Act Amendments (CAAA)

The Clean Air Act Amendments of 1990 are intended to significantly affect transportation

decision making, not only to achieve air quality goals but also to affect broader environmental goals related to land use, travel mode choice, and reduction in vehicle miles traveled. A key section of the Clean Air Act Amendments relating to conformity is Title I, Provisions for the Attainment and Maintenance of NAAQS.

3.27.11.1.4 State of Colorado

The EPA delegates enforcement of the Clean Air Act to the states. In Colorado, this responsibility is given to the Air Pollution Control Division of the CDPHE. All state programs regarding the provisions and enforcement of the Clean Air Act, including State Implementation Plans, are subject to oversight and approval by the EPA.

The EPA has established NAAQS for each of the six criteria pollutants to protect the public from the health hazards associated with air pollution (Table 3-42). The Air Pollution Control Division monitors concentrations of these pollutants, and also monitors for pollutants that do not have a national standard established. These “non-criteria” pollutants include nitric oxide, total suspended particulate, cadmium, arsenic, sulfates, and visibility.

3.27.11.1.5 Intermodal Surface Transportation Efficiency Act

The Intermodal Surface Transportation Efficiency Act of 1991 and subsequent legislation including the Transportation Efficiency Act for the 21st Century (TEA 21), adopted in 1998 (Public Law 105-178) offers tools to help transportation and air quality decision makers carry out the Clean Air Act Amendments mandates. For statutes and implementing regulations, see the Federal Highway Administration home page at <http://www.fhwa.dot.gov/>.

3.27.11.2 Air Quality of the U.S. 287 Realignment Study Area

The Fort Collins area is designated as “attainment/maintenance” for carbon monoxide (CO) and Particulate Matters less than 10 micron (PM₁₀). As of November 20, 2007, the areas in the vicinity of the proposed Glade and Galetton reservoirs have been designated as nonattainment areas for ozone. The U.S. 287 realignment study area is outside of the Fort Collins maintenance area and no Hot Spot analysis is needed for CO. A qualitative analysis of the pollutants of concern (CO, PM₁₀, and air toxics) was performed.

The U.S. 287 realignment study area does not contain industrialized areas or power generating plants. Emission sources for the study area are generated from re-entrained dust and motor vehicle emissions. Based on EPA’s Aerometric Information Reporting System database for Larimer County, there were no exceedances of the NAAQS for carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, particulate (PM₁₀ and PM_{2.5}), and lead for 2000 through 2005 (MERCO 2006b).

3.27.12 Traffic and Transportation

The District’s Proposed Action will affect the segment of U.S. 287 between the intersection of U.S. 287 with Overland Trail Road (LCR 29) northwest of Fort Collins (approximate milepoint (MP) 352.4), and the intersection of U.S. 287 with Owl Canyon Road (LCR 72) (MP 363.2), within unincorporated Larimer County. Along this segment of U.S. 287 within the study area, there is direct access at intersections with LCR 23E (MP 354.2), LCR 54G/56 (MP 354.9), LCR 54E (MP 355.0), and SH 14 at Ted’s Place (MP 355.9). The ROW along U.S. 287 that would be affected ranges from 200 to 250 feet wide.

Table 3-42. National Ambient Air Quality Standards.

Pollutant	Average Time	Concentration
Carbon Monoxide		
Primary	1 Hour ¹	35 ppm
Primary	8 Hour ¹	9 ppm
Ozone		
Primary	8 Hour ²	0.08 ppm
Secondary	Same as primary	
Nitrogen Dioxide		
Primary	Annual arithmetic mean	0.053 ppm
Secondary	Same as primary	
Sulfur Dioxide		
Primary	Annual arithmetic mean	0.03 ppm
Primary	24 Hour ¹	0.14 ppm
Secondary	3 Hour ¹	0.5 ppm
Particulate (PM₁₀)		
Primary	Annual arithmetic mean ⁴	50 mg/m ³
Primary	24 Hour ³	150 mg/m ³
Particulate (PM_{2.5})		
Primary	Annual arithmetic mean ⁴	15 mg/m ³
Primary	24 Hour ⁵	65 mg/m ³
Lead		
Primary	Calendar quarter	1.5 mg/m ³

¹This concentration is not to be exceeded more than once per year.

²The 8-hour Ozone standard is set at 0.08 ppm as the 3-year average of the annual 4th maximum 8-hour average concentration.

³The 24-hour standard is attained when the expected number of exceedances for each calendar year, averaged over three years, is less than or equal to one.

⁴The annual arithmetic mean standard is a 3-year average.

⁵The 24-hour PM_{2.5} standards is based on the 98th percentile.

U.S. 287 is designated as a rural principal arterial roadway on the NHS. North of SH 14, the highway is a two-lane facility generally comprising two 12-foot lanes with approximately 2- to 6-foot shoulders. South of SH 14, U.S. 287 is a divided four-lane facility.

U.S. 287 has an EX access control designation and is currently a designated truck route. According to the State Highway Access Code, under the EX access code designation, access to public streets, roads, and

highways should be planned on no less than 1-mile intervals. No access to private property should be permitted unless reasonable access cannot be obtained from the local roadway system. The access along the existing highway generally conforms to the Access Code, although there are several private access locations serving as field approaches, private residential accesses, commercial accesses, and residential collector access locations (Muller 2006a).

The existing highway has a posted speed of 65 mph and a design speed of 70 mph.

3.27.12.1 *Regulatory Framework and Design Criteria*

Any realignment of U.S. 287 must be approved by CDOT. Approval of the realignment is based, in part, on the proposed realignment meeting specific design criteria. The District and its transportation consultant have coordinated with CDOT to develop the design criteria for the proposed realignment of U.S. 287 (Table 3-43) using CDOT Design Guide 2005, CDOT Standard Plans (October 2000), State of Colorado State Highway Access Code (March 2002), and AASHTO Guide for the Geometric Design of Highways and Streets (2004).

Table 3-43. U.S. 287 Relocation Design Criteria.

Design Parameters	Principal Arterial Rural Highway 70 mph
Percent trucks	18
Design speed (mph)	70
Posted speed (mph)	65
Number of lanes	2
Lane width (ft)	12
Shoulder width rt. / outside (ft)	8
Side slope distance “z” (ft)	8
Minimum clear zone (ft)	30
Maximum superelevation	8%
Minimum horizontal radius (ft)	1,820
Maximum grade (%)	4

The realigned segment of U.S. 287 will have a functional classification of Rural Principal Arterial in rolling terrain. The highway will be designed as a two-lane facility with consideration of an ultimate four-lane divided highway in areas of rock cut and in determination of ROW needs. In order to enhance safety, where feasible, all fill slopes should be

designed to accommodate 4:1 slopes. In addition, where feasible, clear zone in excess of the minimum required should be provided and nontraversable slopes (2:1 or steeper) should be avoided.

Proposed ROW width is approximately 250 feet and accommodates a potential utility corridor on each side of the proposed roadway alignment. The ROW width will be adjusted as necessary to accommodate auxiliary lanes and earthwork slopes.

Access control will conform to Colorado State Highway Access Code EX designation. Intersections should not be spaced closer than 1 mile and no access to private property should be permitted unless other reasonable access cannot be obtained. In accordance with the Access Code at warranted access locations, left-turn deceleration lanes and right-turn auxiliary lanes will be required at any access that has a peak hour turning volume greater than 10 vpd. Left-turn acceleration lanes will be considered where it would benefit the safety and operation of the roadway. A climbing lane will be warranted with sustained grades of 4 percent in excess of 3,000 feet in length.

Climbing lanes will be required when the following criteria are met: upgrade traffic flow exceeds 200 vpd, upgrade truck flow exceeds 10 vpd, and at least a 10 mph speed reduction or one level of service reduction for heavy vehicles. The first two criteria (traffic flow exceeds 200 vpd and upgrade truck flow exceeds 10 vpd) are met under projected conditions. Therefore, the need for climbing lanes will be determined solely by profile grades.

The alignment of the relocated U.S. 287 is planned to utilize property that is owned by Holcim. Portions of the Holcim property have recently been reclaimed following more than 80 years of limestone mining and cement production. An existing haul road was used during the mining operation with mine quarries located on either side of the haul road.

Use of this haul road alignment, within the constraints of design objectives and criteria, is a desirable objective. The design will address the placement of backfilled spoil material placed without formalized compactive effort, which may settle over time and/or in response to loading during highway construction or subsequent loading.

3.27.12.2 Traffic

Larimer County, the North Front Range (NFR) Metropolitan Planning Organization and the Upper Front Range Regional Planning Commission (UFR) have investigated traffic patterns and projections in the vicinity of U.S. 287. The Larimer County 2020 Plan and the NFR 2030 Plan do not identify any capacity improvements to U.S. 287 or to any of the intersecting highways in the study area. The UFR 2030 Plan identifies a new interchange at U.S. 287 and LCR 54G in Laporte and passing lanes and geometric improvement to SH 14 from Ted's Place west. Neither of these improvements would be directly affected by the proposed relocation of U.S. 287.

The existing and projected ADT volumes along U.S. 287 from the Larimer County 2020 Transportation Plan, the draft Larimer County 2030 model, the UFR 2030 Plan, and the CDOT website are shown in Table 3-44.

U.S. 287 north of Ted's Place is currently operating at a volume to capacity ratio of 0.35, the off-peak hour truck percentage is 18.7 percent, and the peak hour truck percentage is 10 percent. In addition, the

CDOT website indicated that the design hourly volume is assumed to be approximately 13 percent of the annual average daily traffic (Muller 2006a).

3.27.12.3 Safety

Investigation of available CDOT data (a 5-year accident history) was evaluated for the period between January 1, 1999 to December 31, 2003 indicates that for the segment of U.S. 287 between Ted's Place and Owl Canyon Road, there were 90 accidents with the predominant type of accidents being fixed objects (28 percent), followed by collisions with wild animals (27 percent). An investigation of the details indicated an assortment of collisions with guardrails, bridge rails, as well as other roadway features within the clear zone. Additionally, impacts with rocks and boulders on the pavement surface were noted.

Of the 90 accidents, five resulted in fatalities. Of the five fatalities, alcohol and drugs were noted as a contributing factor in three of the accidents. Other than alcohol and drugs there does not appear to be a pattern or similarity in the fatal accidents.

3.27.13 Land Use

Land ownership in the U. S. 287 realignment study area is nearly entirely private, with the exception of approximately eight acres of State Land Board land and less than one acre of District land. Most of the northern portion of the study area is used for livestock grazing. Most of the southern portion of

Table 3-44. Traffic and Transportation Report.

Location	Existing ADT				Projected ADT (2030)				
	NFR (2003)	UFR (2003)	LC (1996)	CDOT (2005)	NFR	UFR	LC (2020)	LC	CDOT
U.S. 287 – East of Overland trail	6,100	N/A	6,800	7,600	N/A	N/A	9,500	10,100	12,000
U.S. 287 – West of Overland trail	8,400	8,400	N/A	7,600	N/A	13,500	N/A	5,500	12,400
U.S. 287 – North of SH 14	N/A	5,800	4,600	5,500	N/A	9,800	7,400	6,100	7,900
SH 14 – West of U.S. 287	N/A	2,150	2,350	2,400	N/A	3,500	2,800	3,500	4,100

the study area was historically used for the mining of limestone and production of cement. The Holcim Mine is now decommissioned and portions of the mine have been reclaimed. Some portions of the Holcim Mine were subdivided and sold at a public auction in September 2005 for rural residential large lot development.

3.27.14 Socioeconomic Resources

The APE was defined as 20 miles to the immediate west of U.S. 287 and 9.8 miles to the east of U.S. 287. The APE is sparsely populated and had a total of 181 residents comprising 78 households in 1999. The majority of the population is white. Those of

Hispanic origin comprise about 1 percent of the population, which is significantly less than the Hispanic population (20 percent) for the combined service area for the Participants. It was estimated that eight households are below the poverty level in the APE (HDR and BBC 2007).

3.27.15 Hazardous Sites

Hazardous sites were discussed earlier in Chapter 3 in a regional context. The decommissioned Holcim Mine has a cement kiln dust disposal area that will be avoided by the realignment of U.S. 287. A Phase 1 environmental site assessment will be done for any realignment alternative ROW approved by CDOT.

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Chapter 4

Environmental Consequences

4.1 INTRODUCTION

Chapter 4 describes the direct, indirect, and cumulative effects that would be expected to occur as a result of implementing each alternative described in Chapter 2. The best available information was used to determine effects. Detailed discussions are associated with potentially significant or complex effects, and brief descriptions are associated with minor effects. Most of the significant effects to resources are associated with project facilities (direct effects) or proposed project operations that will alter the flows in the Cache la Poudre and South Platte rivers (indirect effects).

4.1.1 Chapter Organization

Chapter 4 begins with a discussion of effects common to all action alternatives and a comparison of effects among alternatives. The chapter then describes the effects by resource. Mitigation is summarized at the end of each resource section and presented in greater detail in Chapter 5—Environmental and Other Commitments.

During the scoping process, it became clear that much of the public is interested in the proposed realignment of U.S. 287; therefore, the environmental consequences for the U.S. 287 realignment are repeated in Section 4.29. The separate presentation of this information should

facilitate review by those primarily interested in U.S. 287 realignment issues.

Irreversible or irretrievable commitment of resources are discussed in Section 4.27 and cumulative effects are presented in Section 4.28. Table 4-20 at the end of this chapter provides a comprehensive summary of effects for all alternatives by resource and issue.

4.1.2 Terms Used in This Chapter

4.1.2.1 Direct, Indirect, and Cumulative Effects

Direct impacts or effects are those that would directly result from implementing one of the alternatives. Most direct effects would occur from construction of facilities (e.g., dams and pipelines, and inundation by reservoirs). Indirect effects are those that are project-induced, but occur later in time or are farther removed in distance. The primary indirect effects will be associated with resources affected by project-related flows in the Cache la Poudre and South Platte rivers, but could include the economic effects of transferring agricultural water to M&I use.

A cumulative effect is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions” (40 CFR Part 1508.7). For example, the combined effects on streamflows from NISP and other proposed water supply projects in the region would be a cumulative effect.

4.1.2.2 Short-term and Long-term Effects

Effects are described as either short-term or long-term for each resource. For the purposes of this analysis, short-term impacts are estimated to persist for 5 years following disturbance and would result

primarily from temporary construction disturbances that either would be reclaimed (e.g., pipelines) or would cease (e.g., construction noise). Long-term impacts are expected to be permanent (e.g., dams or the realignment of U.S. 287) or will occur periodically over the life of the project (e.g., reservoir inundation).

4.1.2.3 Irreversible or Irretrievable Commitment of Resources

NEPA requires a discussion of any irreversible or irretrievable commitment of resources that would result from implementing the alternatives. The irreversible or irretrievable commitment of resources is discussed in Section 4.27. An irreversible commitment of resources means that nonrenewable resources are consumed or destroyed; these resources are permanently lost due to project implementation. For example, fossil fuel resources used during construction would represent an irreversible commitment of resources because their use is lost for future generations.

In contrast to an irreversible commitment of resources, an irretrievable commitment of resources is the loss of resources or resource production, or use of renewable resources during project construction and during the period of time that the project is in place. Irretrievable commitments are not permanent; they are limited to a specific time frame. For NISP, the time frame for irretrievable resource commitments is the period of time that NISP remains in place or temporary facilities or disturbances remain. For example, native plant communities disturbed during construction but not inundated or covered by an impermeable surface represents an irretrievable loss of resources. In this example, the period of time between disturbance and complete revegetation represents an irretrievable loss of resources.

4.1.2.4 Significance

The significance of effects as defined by NEPA requires consideration of both context and intensity (40 CFR Part 1508.27). Context considers the locale of the impact and the region. Intensity considers the severity of the impact, including beneficial as well as adverse impacts; effects on public health or safety; unique characteristics of the study area; whether the effects are highly controversial; whether there are highly uncertain effects or unique or unknown risks; whether the action establishes a precedent; whether the action is related to other actions with individually insignificant but cumulatively significant effects; whether historic, cultural, or scientific resources are affected; whether endangered or threatened species are involved; and whether the action threatens to violate federal, state, or local requirements protecting the environment.

4.2 EFFECTS OF ALTERNATIVES

4.2.1 Effects Common to All Action Alternatives

Potentially significant effects common to all of the action alternatives or effects associated with issues of interest expressed during the scoping process that are common to all of the action alternatives are presented in Table 4-1. Effects for all alternatives are summarized at the end of Chapter 4 in Table 4-20.

4.2.1.1 Changes to Poudre River Flows

All of the action alternatives (Alternatives 2, 3, and 4) have the SPWCP as a component and would divert water from the Cache la Poudre and South Platte rivers. Many of the common effects are associated with changes in streamflows. All of the action alternatives would affect flows in the Poudre

River in two ways. First, water would be diverted from the Poudre River when the District's Grey Mountain water right is in priority. The District does not currently exercise the Grey Mountain water right; therefore, these diversions would cause new depletions to the Poudre River. The diversions would occur primarily from the Poudre Valley Canal during periods of high flows; thus, the greatest changes in flows would typically occur in May, June, and July of wet and average years. Diversions when the Grey Mountain water right is in priority would affect flows in about 55 miles of the Poudre River from the Poudre Valley Canal to the confluence with the South Platte River. Alternative 2 would use the existing Munroe Canal diversion as a secondary point of diversion (Section 2.4.1.7).

Second, all action alternatives also would involve an exchange of water diverted from the South Platte River for water diverted from the Poudre River (see Section 2.3.2). The exchange involves diverting water from the Poudre River at the Poudre Valley Canal, which is currently diverted from the Poudre River about 23 miles downstream for irrigation. The exchange diversions would not be new to the Poudre River, but would occur about 23 miles higher in the Poudre River. Therefore, the exchange would reduce flows in the reach of the Poudre River from the Poudre Valley Canal to the diversion for the New Cache Canal. The exchange would not affect existing flows on the Poudre River downstream of the New Cache Canal diversion, which is the most downstream anticipated exchange location. The exchange would reduce existing flows in about 23 miles of the Poudre River, from the Poudre Valley Canal downstream of the mouth of Poudre Canyon, through Laporte and Fort Collins, to about 12 miles downstream of Fort Collins.

Table 4-1. Effects Common to All Action Alternatives.

Resource/Issue	Effect
Stream Morphology	
Effects would be greatest below Fort Collins to above Greeley	Reduced May-June streamflows may cause: <ul style="list-style-type: none"> • Channel narrowing • Greater sediment deposition and less sediment flushing • Vegetation encroachment into the channel, especially in areas of greater sediment deposition • Increase in the size of in-channel islands • Flow obstruction and flooding • Reduced scouring and channel rejuvenation • Bank erosion
Wetlands	
Galeton Reservoir	Galeton Reservoir (40,000 AF) would inundate 0.2 acre of wetlands.
Riparian Resources	
Poudre River downstream of Laporte	Decreases in streamflow and stream stage during the growing season may affect riparian vegetation in areas influenced by streamflow (e.g., depressions and backwater channels linked to the river). Localized changes to riparian herbaceous and shrub vegetation may occur.
Recreation	Poudre River streamflows downstream from the Poudre Valley Canal diversion would be reduced. This would potentially affect boating recreation on the Poudre River from Shields Street to Prospect Street in Fort Collins. The SPWCP requires the construction of a 21-acre forebay within the 67-acre Mitani-Tokuyasu SWA, located at the confluence of the Poudre and South Platte rivers. Waterfowl hunting is a popular activity at this location. The construction of this forebay would inundate the parking area and a portion of the access road, although it may provide improved habitat for waterfowl.
Land Use–Galeton Reservoir	
Agriculture	Galeton Reservoir would inundate 454.6 acres of nonirrigated Prime or other Unique Farmland at 40,000 AF and 328.6 acres of nonirrigated Prime Farmland at 20,000 AF (irrigation not needed for Prime or other Unique Farmland status for these soils). The Galeton Reservoir forebay would permanently affect 20.9 acres of Prime Farmland if irrigated (it is currently irrigated). Portions of a grazing lease on State Land Board lands would be inundated (36.4 acres at 40,000 AF and 3.9 acres at 20,000 AF).
Access	Construction of the SPWCP forebay would inundate a portion of the access road and the parking area of the Mitani-Tokuyasu SWA.
Utilities	The proposed Cheyenne-Totem gas pipeline would run parallel to the SPWCP pipeline and would cross the proposed Galeton forebay.
Socioeconomic	
Recreational Values	There would be an estimated gain of \$165,600 annually above the mouth of Poudre Canyon, and a loss ranging from \$0 to \$700,000 annually along the Poudre River trail and a loss of \$228,700 for boating and fishing through Fort Collins associated with reduced flows.
Agriculture	SPWCP would increase salinity levels in irrigation water used for exchange and would reduce the yield of salinity-sensitive crops such as dry beans and vegetables. The reductions would be less than 0.1 percent of the overall agricultural output of Weld County.
Population Growth and Economic Growth	Implementation of any of the alternatives would not change land-use or zoning, increase employment opportunities, or increase other regional growth pressures.
Water Bills and Affordability	Participants are expected to increase water resource fees on new residential connections to a minimum of \$12,000 by 2011. Participants that are able to provide relatively affordable water service at present are projected to continue to have affordable rates in the future under any of the action alternatives. Participants with rates that currently exceed the affordability threshold are generally projected to continue to have relatively high rates through 2025 under each of the alternatives. Affordability of water service appears to be of most concern for the Morgan County Quality Water District.

The greatest effect of the action alternatives on Poudre River flows would be the combined effect of the exchange, which would involve moving existing diversions about 23 miles up the river and the exercise of the Grey Mountain water right. This combined reduction in flow would occur on an approximate 23-mile reach of the Poudre River from the Poudre Valley Canal, downstream of the mouth of Poudre Canyon to the diversion for the New Cache Canal about 2 miles south of Timnath. The SPWCP exchanges would be divided equally between the Larimer-Weld Canal and the New Cache Canal. The Larimer-Weld Canal diversion is located about 10 miles upstream of the New Cache Canal. Flow reductions in this reach are represented by the Lincoln Avenue stream gage in Fort Collins (Figure 3-3).

The District's Proposed Action (Glade Reservoir and the SPWCP) would reduce average monthly streamflow at the Lincoln Avenue gage in most months in most years (Table 4-2). The highest percentage (71.3 percent) reduction in flow would occur in May of average years. The District's Proposed Action would substantially reduce monthly average streamflow at the Lincoln Avenue gage in May, June, July, and August of all years, ranging from a 71 percent reduction in May of average years to a 26 percent reduction in streamflow in August of dry years (Table 4-2).

The reduction in streamflow to the Poudre River at the Lincoln Avenue stream gage for Alternatives 3 and 4 is similar to the District's Proposed Action with the exception that Alternative 3 (Cactus Hill Reservoir and SPWCP) and Subalternative 4.2, which also includes Cactus Hill Reservoir, have slightly greater streamflow reductions in wet and average years. For example, alternatives involving Cactus Hill Reservoir would have a 62 percent reduction in average monthly streamflows in June of wet years at the Lincoln Avenue gage compared to a

59 percent reduction in streamflow in June of wet years for the District's Proposed Action. This difference is due to the larger size of the proposed Cactus Hill Reservoir (180,000 AF) compared to the proposed Glade Reservoir (170,000 AF) and conveyance losses associated with transporting water to Cactus Hill Reservoir. Cactus Hill Reservoir is proposed to be larger to compensate for increased evaporation on the plains relative to the higher elevation foothills location of Glade Reservoir.

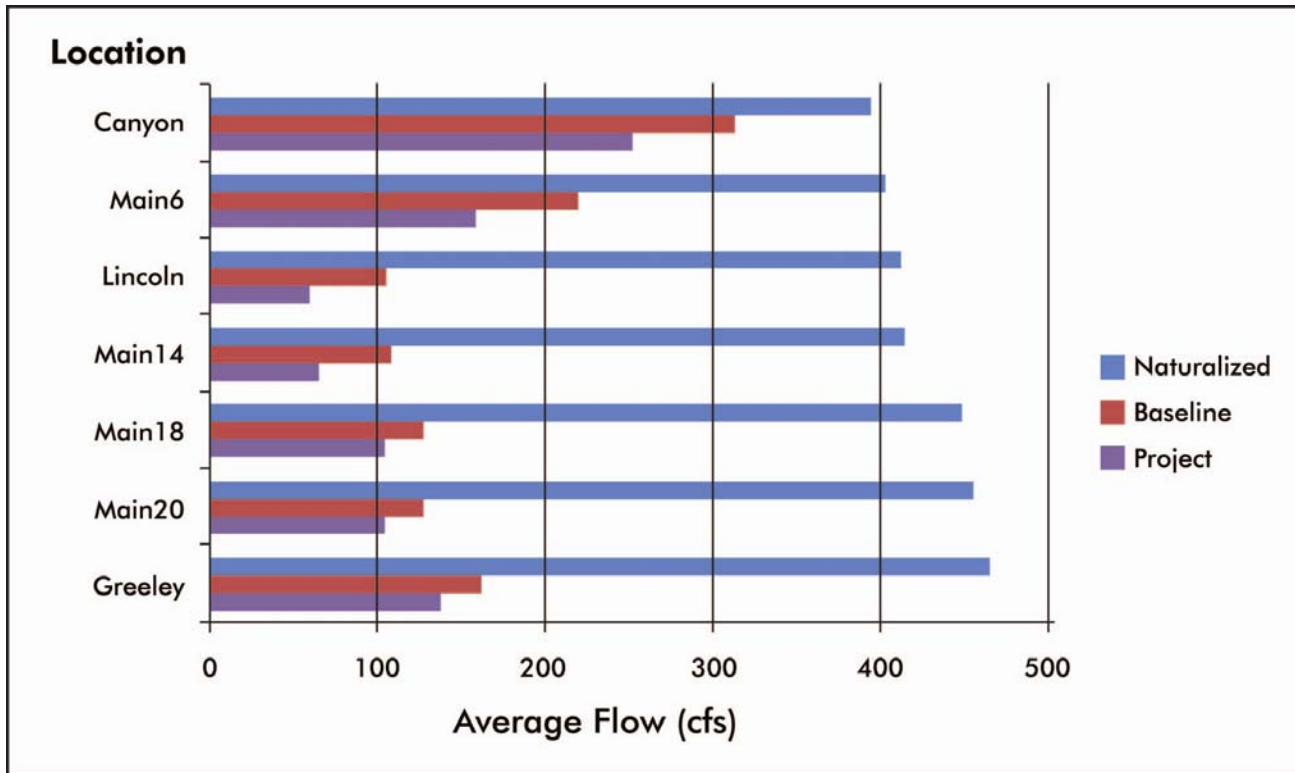
Table 4-2. Average Monthly Streamflow (cfs) at the Lincoln Avenue Stream Gage for the District's Proposed Action.

Type of Flow and Representative Year	May	June	July
<i>Baseline</i>			
Wet	280.83	908.44	252.65
Average	188.60	529.40	174.50
Dry	131.12	215.44	66.41
<i>Projected Flows</i>			
Wet	163.50	368.90	172.27
Average	54.13	245.47	93.43
Dry	43.79	116.69	23.20
<i>Change in Flow</i>			
Wet	-117.33	-539.54	-80.38
Average	-134.47	-283.93	-81.07
Dry	-87.33	-98.75	-43.21
<i>Percent Difference</i>			
Wet	-41.8%	-59.4%	-31.8%
Average	-71.3%	-53.6%	-46.5%
Dry	-66.6%	-45.8%	-65.1%

Note: A table showing all months of the year is presented in Appendix A.

The estimated natural flows of the Poudre River have been altered over the last 148 years (Anderson 2008; ERO 2008f). The greatest alterations in natural flow have occurred in the lower reaches of the Poudre River. The action alternatives will add to the trend of reduced flows in the Poudre River (Figure 4-1).

Figure 4-1. Average Flows for the Poudre River for Naturalized, Baseline, and NISP (Project) Conditions.



Source: Anderson (2008).

The action alternatives will reduce the occurrence and duration of the higher flows (Table 4-3). In some instances, the currently infrequently occurring high flows would no longer occur with the action alternatives. In other instances, the occurrence and duration of the high flows would be reduced by the action alternatives (Table 4-3).

Flow reductions in the Poudre River are likely to have significant localized effects on:

- Water-based recreation and recreation values
- Riparian resources
- Stream morphology

Table 4-3. Summary of Spells Analysis for Selected Stations on the Poudre River.

Station	Period of Record	Flow Threshold (cfs)	Number of High Spells ¹		Longest High Spell (days)		Mean Duration of High Spell (days)		Total Duration of High Spell (days)		Mean Magnitude of High Spell (cfs)	
			Baseline	Project	Baseline	Project	Baseline	Project	Baseline	Project	Baseline	Project
Lincoln	1975-1999 24 years	3,600	4	0	7	n/a	3.25	n/a	13	n/a	4,135	n/a
		2,000	17	5	34	22	5.5	5.6	93	28	2,550	2,415
Lincoln	1975-1999 24 years	3,400	5	0	8	n/a	3.8	n/a	19	n/a	4,027	n/a
		1,600	19	9	34	29	7.2	5.9	136	53	2,331	2,059
Main 12	1975-1999 24 years	1,400	19	10	36	37	9.47	8.8	180	88	2,387	1,887
		800	33	24	48	44	10.33	10.5	341	252	1,745	1,583
		400	64	56	74	59	11	9.5	707	532	1,134	949
Main 14	1975-1999 24 years	2,400	10	5	31	6	5.1	3.2	51	16	2,989	2,838
		1,400	20	12	36	35	8.9	6.3	178	76	2,302	1,958
Main 14	1975-1999 24 years	3,800	3	0	5	n/a	2.67	n/a	8	n/a	4,295	n/a
		2,300	9	4	33	11	6.22	4.75	56	19	3,035	2,886
		400	93	73	74	57	7.5	6.59	697	481	899	786
		200	167	136	84	75	7.4	6.8	1,235	921	558	511
Main 18	1849-1999 50 years	3,600	5	1	5	1	2.8	1	14	1	4,279	4,288
		1,900	28	7	31	19	4.3	4.3	120	30	2,726	2,638

¹The spells analysis compares the occurrence and duration of flow events with and without the Proposed Action.

Source: Anderson (2008).

4.2.1.2 Stream Morphology

All of the action alternatives (Alternatives 2, 3, and 4) would reduce flows in the Poudre and South Platte rivers, as described in Sections 4.2.1.1 and 4.3.

South Platte River. The period of high spring runoff flows in the South Platte River has historically begun in May and peaked in mid-June. Bankfull and greater flows are most likely to occur during this time. NISP's maximum pump capacity at the South Platte River intake is 200 cfs, which is lower than the average flow of 500 to 700 cfs that occur during much of the year at the Kersey gage.

Channel-forming flows (1.5-year peak flows of 3,858 cfs) would occur or be exceeded about 3 percent of the time. Under the action alternatives, flows of this magnitude would occur less than 1 percent of the time. High flows of up to about 24,200 cfs were modeled to occur under existing conditions; flows exceeding about 22,600 cfs would not occur under the action alternatives. Scouring flows equivalent to the 25-year peak flows would continue to occur in the South Platte River under the action alternatives. It is unlikely that implementation of NISP would affect the morphology of the South Platte River downstream of the confluence with the Poudre River (ERO 2008h).

Cache la Poudre River. The period of high spring runoff flows in the Poudre River has historically begun in May and peaked in mid-June. Bankfull and greater flows are most likely to occur during this time. At the Canyon gage, channel-forming flows (1.5-year peak flows of 1,988 cfs) would be exceeded about 1 percent of the time under the action alternatives, or about 2 percent less than under existing conditions. High flows of up to 5,300 cfs were modeled to occur under existing conditions; flows exceeding about 4,000 cfs would not occur

under the action alternatives. At the Lincoln Street gage, channel-forming flows (1.5-year peak flows of 891 cfs) would be exceeded almost 2 percent of the time, or about 2 percent less than under existing conditions. High flows up to 4,600 cfs were modeled to occur under existing conditions; flows exceeding about 3,250 cfs would not occur under existing conditions. At the Greeley gage, channel-forming flows (1.5-year peak flows of 736 cfs) would be exceeded slightly more than 1 percent of the time under the action alternatives, or about 2 percent less than under existing conditions. For flows exceeding 3,000 cfs (scouring flows), flows would be reduced under the action alternatives by about 1,350 cfs.

NISP's maximum pump capacity at the Poudre Valley Canal (when the reservoir would be nearly empty) is 1,200 cfs and the average diversion from the Poudre River is estimated to be about 1,000 cfs. The maximum pumping rate could be accomplished only during spring high flows when the District's Grey Mountain water right is in priority. The modeled baseline conditions show that flows equal to or exceeding 1,000 cfs occur for an average of 44 days and flows equal or exceeding 1,200 cfs (up to 1,550 cfs) occur for an average of 35 days from late May through early July. Under the action alternatives, flows exceeding 1,200 cfs would occur much less frequently and flows equal to or exceeding 1,000 cfs would occur for an average of 27 days during late May through early July. The maximum average daily flow change from baseline conditions would occur in June and would be about 365 cfs for the Glade Reservoir alternatives and 390 cfs for the Cactus Hill alternatives.

From the canyon mouth to Fort Collins, the action alternatives would be expected to increase bed and bank stability, but episodic erosion would still occur in response to large flood events. Some channel contraction would be expected in deposition zones.

The most significant impacts of the action alternatives on stream morphology and sediment transport would be expected to occur between Fort Collins and Greeley. The existing process of channel contraction via sediment deposition and vegetation encroachment would be expected to accelerate. In Greeley and downstream to the South Platte River confluence, the same process would be expected to continue, but the effect of the action alternatives would be smaller. For additional more detailed analysis of the channel morphology of the Poudre River, see the Morphology and Sediment Transport Technical Report for the Cache la Poudre River (Anderson 2008).

4.2.1.3 Wetlands

The SPWCP is common to all action alternatives and Galeton Reservoir, a component of the SPWCP, would inundate about 0.2 acre of wetlands. Reductions in streamflow may affect wetlands directly linked and supported by flows in the Poudre River.

4.2.1.4 Riparian Resources

Much of the area adjoining the Poudre River has been significantly altered (e.g., channelization, construction of levees, bank stabilization, filling of oxbows and meanders, and channel narrowing that has unlinked the adjacent riparian areas from the dynamics of the river). However, there are localized riparian resources that appear to still be linked to river dynamics that affect the distribution and maintenance of riparian vegetation (e.g., inundation, shallow alluvial ground water levels, and periodic alteration of habitat). These riparian resources are potentially sensitive to reductions in streamflow and stage and primarily occur in scattered locations between Laporte and I-25 (Figure 3-14). Many of these riparian areas have been designated as natural areas by Fort Collins.

Cache la Poudre River. The reductions in streamflows on the Poudre River associated with the action alternatives are not anticipated to cause a loss of riparian and/or wetland vegetation. The greatest reductions in streamflow on the Poudre River will occur at high flows during late spring and early summer. Wetland and riparian vegetation appear to be supported by the lower more frequently occurring flows (ERO 2008a). However, a reduction in the infrequently occurring overbank flows in the reach above I-25 may affect the periodic disturbance of the riparian zone that can aid in creating new habitat for riparian vegetation establishment and rejuvenation of the riparian zone. Without this disturbance and a substantial reduction in the frequency of this occurrence of overbank flows, it is likely that the woody riparian vegetation will become increasingly decadent. This would be a slow process that would be difficult to separate from current trends in riparian vegetation along the Poudre River. Downstream of I-25, reduced high flows on the Poudre River would likely contribute to or accelerate the trend of encroachment of riparian and wetland vegetation (primarily reed canarygrass and coyote willow) into the channel (Anderson 2008). The continued trend of riparian and wetland vegetation encroachment may expand the distribution of wetland and riparian vegetation in this reach of the Poudre River; however, the regeneration of riparian trees in this reach is not commonly occurring.

South Platte River from Poudre River Confluence to Kersey. The minor changes in stream stage in this reach would not likely affect riparian and wetland vegetation.

4.2.1.5 Recreation

All of the action alternatives would reduce flows on the Poudre and South Platte rivers. The reduced flows on the Poudre River would occur from the Poudre Valley Canal near the mouth of the Poudre

Canyon to the confluence of the Poudre River to the South Platte River. The reduced flows in the Poudre River would occur downstream of the reaches of the Poudre River most frequently used for recreational boating. Reduced Poudre River flows would affect recreational boating through Fort Collins. Some canoeing, kayaking, and tubing does occur on the Poudre River through Fort Collins from approximately Shields Street to Prospect Street.

The forebay for the SPWCP would occupy about 21 acres of the 67-acre Mitani-Tokuyasu SWA and displaces access and parking. The forebay may provide habitat for waterfowl. Waterfowl hunting is a popular activity at this SWA.

4.2.1.6 Land Use

The SPWCP and Galeton Reservoir are common to all action alternatives. Galeton Reservoir (40,000 AF, Alternatives 2 and 3) would inundate about 454.6 acres or about 328.6 acres (20,000 AF, Alternative 4) of Prime or Unique Farmland. The proposed Galeton Reservoir site is not irrigated; however, the soils at the site do not need to be irrigated to be considered Prime or Unique Farmland. The forebay would affect about 20.9 acres of currently irrigated Prime or Unique Farmland.

Galeton Reservoir would inundate about 36.4 acres (40,000 AF) or 3.9 acres (20,000 AF) of a grazing lease on State Land Board lands. The forebay would inundate a portion of the Mitani-Tokuyasu SWA parking area and access road. The proposed Cheyenne-Totem gas pipeline would run parallel to the SPWCP pipeline and would cross the proposed forebay. The gas pipeline would need to be rerouted or the footprint of the forebay would need to be revised.

4.2.1.7 Socioeconomics

Socioeconomic impacts associated with all of the action alternatives include impacts to:

- Recreational resources
- Agriculture
- Population growth and economic growth
- Water bills and affordability

During scoping these issues were identified as potential socioeconomic issues of interest.

4.2.1.7.1 Recreational Values

The Galeton Reservoir and forebay and the diversion of flows from the Cache la Poudre River would impact water-based and terrestrial recreation activities under all action alternatives. Direct and indirect impacts to the value of recreation are based on impacts to visitation and recreation activities documented in the Recreation Resources Technical Report (ERO 2008e). Moderate to major benefits and impacts to recreational values are discussed below. Table 4-4 summarizes the annual quantifiable impacts to recreational values resulting from the action alternatives. The values of recreational resources cannot be totaled, because not all values are annual and impacts do not occur with every action alternative.

Poudre River Recreation. Impacts on recreation values on the Poudre River occur because changes in flows associated with the action alternatives impact visitation levels, length of the recreation season and the value of the recreational experience.

The use of the Munroe Canal diversion, under Alternative 2 or 4 with Glade Reservoir only, as a secondary project diversion point during the summer months, rather than the Poudre Valley Canal diversion, would benefit kayakers and (potentially) rafters on the Filter Plant Run by extending the recreational season into August. Potential benefit to

Table 4-4. Quantifiable Recreation Value Impacts Resulting from the Action Alternatives (\$ per year).

Recreation Resource	Recreation Value, Existing Conditions	Recreation Value, Action Alternatives	Change in Recreation Value
Filter Plant Run	\$504,000	\$669,600	\$165,600
Horsetooth Reservoir, annually	\$21,597,200	\$21,597,200	\$0
Carter Lake (peak season weekend)	\$103,400	\$103,400	\$0
Poudre River, Picnic Rock (weekend in June)	\$16,000	\$16,000	\$0
Poudre River, through Fort Collins, annually	\$1,433,560	\$1,154,680	-\$228,720
Poudre River trail, through Fort Collins, annually	\$8,019,360	\$7,322,030 to \$8,019,360	\$0 to -\$697,340
Natural Areas along the Poudre River (less recreation on the Poudre River trail), annually	\$4,852,640	\$4,852,640	\$0
Mitani-Tokuyasu SWA	\$48,000	\$48,000	\$0
Galeton Reservoir, annually	N/A	No public recreation	\$0
Cactus Hill Reservoir, annually	N/A	No public recreation	\$0
Glade Reservoir, motorized, annually	N/A	\$16,777,700	\$16,777,700
Glade Reservoir, nonmotorized, annually	N/A	\$17,115,400	\$17,115,400

Source: HDR and BBC 2007.

recreational value of the Filter Plant Run could reach approximately \$165,600 annually if kayakers and rafters continue to use the run in August at the same average rate it is used in May through July (Table 4-4). This is considered to be a moderate benefit to the recreational value of the Filter Plant Run.

The reach of the Poudre River from MAIN6 (near Laporte) to MAIN14 (just west of I-25 below the Environmental Learning Center (ELC)) would likely experience the most adverse impact resulting from the action alternatives because most of the changes in flow would occur along this reach. This reach of the river is considered an important economic asset to the City of Fort Collins. In May and July of most years, the action alternatives would reduce flows along this reach below levels needed for kayaking and canoeing. Reduced flows could result in an adverse impact to recreational values of up to \$228,700 annually, primarily impacting boating activities, by shortening the kayaking and rafting

season. Reductions in flow may also adversely impact recreation activities on the Poudre River trail, resulting from a reduction in the aesthetic quality of the recreation experience. Since aesthetic impacts are anticipated to be negligible, economic impacts are uncertain, but are expected to be similarly negligible. However, given the high usage of the trail, even small changes in the recreation experience, and associated unit-day value, could translate into relatively high economic impact estimates. Given these uncertainties, the impact is estimated to lie within a range of no measurable impact to approximately \$700,000 annually, with the latter figure reflecting a less than 10 percent reduction in the value of the experience. Activities at the ELC along this reach also may be minor to moderately impacted as a result of reduced flows.

Galeton Reservoir and Forebay. Galeton Reservoir would indirectly increase the value of the hunting and wildlife viewing experiences on nearby private

lands and on the Pawnee National Grassland. No public access, recreation opportunities, or recreation-related facilities are planned at the Galeton Reservoir; therefore, no visitation increases are expected from the construction of Galeton Reservoir.

The proposed Galeton forebay would be located in the Mitani-Tokuyasu SWA and would use a substantial portion of the state land area. The Mitani-Tokuyasu SWA is approximately 67.3 acres, and the Galeton forebay is expected to inundate approximately 21 acres. CDOW has requested that components be considered in the design of the forebay that minimize impacts to Mitani-Tokuyasu SWA and improve the recreational experience at the SWA. Dependent upon the design of the forebay and measures taken to preserve or enhance Mitani-Tokuyasu SWA, there may be only minor impacts to visitation during construction. There could be benefits to the recreational experience at Mitani-Tokuyasu SWA resulting from improved habitat and mitigation. Overall, the impact to the recreational value of Mitani-Tokuyasu SWA is expected to be minor to moderate.

Construction and operation of the proposed Galeton forebay would permanently inundate a portion of the SWA access road and the parking area. However, construction of the forebay may attract waterfowl and small game. The District has agreed to allow continued public access to the SWA. CDOW stated that it may view the construction of the forebay as a benefit to recreation at the Mitani-Tokuyasu if proper mitigation measures are taken (Rogstad, pers. comm. 2007). The proposed Cheyenne-Totem gas pipeline also would cross the proposed forebay and either the pipeline alignment of the forebay footprint would need to be adjusted.

Construction of the proposed Galeton Reservoir likely would not provide many recreational fishing

opportunities because of its proposed size, shallow depth, and water fluctuations (Hoover 2005). The lands surrounding the proposed Galeton Reservoir are private and would likely be acquired by the District prior to construction. The lands are currently not planned to be managed for recreational uses.

4.2.1.7.2 Agriculture

All the action alternatives include the exchange of water from the Poudre River currently used by agriculture for irrigation, for South Platte River water through the SPWCP. The SPWCP would result in increased levels of salinity in irrigation water, potentially affecting crop yields (Hoffman 2004).

Under Alternatives 2 and 3, approximately 60,000 acres of irrigated farmland east of U.S. 85 in Northern Weld County would potentially be affected by the SPWCP exchange (affected area) (HDR and BBC 2007). Under Alternative 4, which incorporates a smaller Galeton Reservoir, approximately one-half as much irrigated acreage would be affected.

SPWCP would increase salinity levels in the irrigation water used for the exchange creating yield impacts for dry beans and vegetables, two of the most salinity-sensitive crops in Weld County (Hoffman 2004). Dry beans and vegetables account for close to 9 percent of total acreage of crops within the affected area. Assuming the use of gravity-type irrigation systems and a mix of 50 percent SPWCP water and 50 percent existing supplies, Alternatives 2 and 3 could reduce dry bean yields by up to 8 percent and vegetable yields by up to 5 percent on affected lands (HDR and BBC 2007). Yield reductions would result in decreased production value of approximately \$78,700 for dry beans and \$224,700 for vegetables, or about 1 percent of total production value of the lands that would potentially

participate in SPWCP, and less than 0.1 percent of overall agricultural output in Weld County.

The indirect effects associated with decreased yields would be minor, representing a very small percentage of economic output and total income in the region. There would be no impact to employment in the region as a result of decreased yields (IMPLAN 2006).

The District and the Participants intend to compensate irrigators for their participation in the SPWCP. Estimated costs for these payments were included in the cost of the alternatives and were considered in the financial impact analyses.

Because the action alternatives would require up to 60,000 acres of irrigated lands west of Galeton Reservoir to facilitate the exchange, the action alternatives could help provide incentives to maintain up to 60,000 acres of irrigated agricultural lands compared to the No Action alternative that would remove the irrigation from approximately 69,200 acres of irrigated agricultural lands, or Alternative 4 that would remove the irrigation from 17,150 acres of irrigated agricultural lands.

4.2.1.7.3 Population Growth and Economic Growth

All of the alternatives are designed to meet anticipated water needs of the growing Participant communities. Implementation of any of the alternatives would not change land use or zoning, increase employment opportunities, or increase other regional growth pressures. Population growth and development in the region served by the Participants would likely continue regardless of whether any of the alternatives are constructed. However, availability of sufficient water supplies from existing public water systems and municipalities, such as the Participants, may help steer growth into those areas best prepared to provide adequate infrastructure for new residents.

4.2.1.7.4 Water Bills and Affordability

Projected total capital costs for the action alternatives range from about \$426 million for the Proposed Action (Alternative 2) to about \$596 million (Alternative 4). Total capital costs for the No Action alternative are projected to be about \$830 million (HDR and BBC 2007). To support project financing under each alternative, the Participants are expected to increase their water resource fees on new residential connections to a minimum of \$12,000 by 2011. (Some Participants currently require developers to purchase C-BT units and pay a tap fee. If these Participants require an equivalent cash payment instead, all Participants will already be charging at least \$12,000 per new connection.) For some Participants, increases in water user charges (rates) also may be necessary to meet the revenue requirements associated with developing new water supplies. User rate increases may affect the affordability of potable water in some Participant communities. Affordability was examined based on the average annual water bill in relation to median household income. Communities with average annual water bills exceeding 2 percent of median household income were identified for potential risk. Affordability of water service appears to be of most concern for Fort Lupton, Fort Morgan, and MCQWD.

Table 4-5 presents the average residential water bill for the Participants in 2006 and the projected changes in the annual bill under each alternative in 2010 and 2020. After adjusting for inflation, average annual water rates are projected to increase between 10 percent (Alternative 2) and 38 percent (No Action alternative) by 2010. By 2020, inflation adjusted rates would be similar to 2006 rates under the action alternatives and about 17 percent higher than 2006 rates under the No Action alternative.

Any changes in the yield requested from NISP by individual Participants or their decision to participate

Table 4-5. Summary of Average NISP Rate Impacts by Alternative.

	No Action Alternative 1	Alternative 2	Alternative 3	Subalternative 4.1	Subalternative 4.2
Average residential bill					
2006	\$569	\$569	\$569	\$569	\$569
2010	\$850	\$680	\$689	\$733	\$743
2020	\$875	\$707	\$716	\$753	\$760
Average incremental increase in residential bill over 2006					
2010	+ \$281	+ \$111	+ \$120	+ \$164	+ \$174
2020	+ \$306	+ \$138	+ \$147	+ \$184	+ \$191
Cumulative user charge rate increase					
2010	48.8%	19.4%	21.0%	28.7%	30.4%
2020	17.5%	24.2%	25.8%	32.1%	33.3%
Inflation-adjusted rate increases					
2010	38.0%	10.4%	11.8%	19.1%	20.6%
2020	16.5%	-5.8%	-4.6%	0.2%	1.2%

Note: All projections are in nominal dollars, including inflation. The affordability analysis assumes median household incomes will increase at the rate of inflation (2 percent per year).

Source: Red Oak Consulting 2006; BBC Research and Consulting 2006.

in the proposed project could affect the costs borne by the remaining Participants. NISP participation is relatively equally divided among the Participants, with only the Town of Erie (17 percent of the total), CWCWD (18 percent of the total), and LHWD (12 percent of the total) subscribing to substantially larger than average contract rights (about 8 percent) of the Project. Given the substantial growth occurring in the region served by the Participants, it is also likely that there could be a market for “NISP contracts” after the project becomes operational, such as currently exists for C-BT units. Consequently, NISP does not appear overly vulnerable to potential changes in participation by individual Participants.

4.2.2 Comparison of Alternatives

As discussed, the action alternatives have many common impacts. These effects common to all action alternatives demonstrate the potential environmental consequences of the alternatives, but

do not help distinguish the alternatives. The following comparisons of all of the alternatives focus on resources and issues that assist in distinguishing the alternatives. Most of the distinguishing impacts for the action alternatives are direct effects associated with the facilities of the alternatives. Table 4-6 compares the distinguishing effects of the alternatives on resources. The term “no distinguishing effect” (NDE) does not mean there is no effect to the resource or issue associated with the alternative. It means that the effect to the resource or issue is not unique to the alternative in a way that helps distinguish among the alternatives. For example, only the alternatives involving Glade Reservoir would affect Preble’s meadow jumping mouse; therefore, effects to this resource help distinguish among the alternatives. Conversely, all of the alternatives will affect wildlife and wildlife habitat relatively equally; therefore, the effects to wildlife do not help in comparing or distinguishing among the alternatives.

Table 4-6. Distinguishing Effects of the Alternatives.

Resource/Issue	Alternative 1 No Action	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Surface Water	Transfer of existing consumptive use will not reduce streamflows except for reaches where current diversions are moved upstream.	Streamflows reduced in the Poudre and South Platte Rivers due to exercise of new water rights and exchanges that move points of diversion upstream of the Poudre River.	Similar to Alternative 2; however, Cactus Hill Reservoir would be 10,000 AF larger than Glade Reservoir and would have greater reductions in streamflows than Alternative 2.	Deriving 12,000 AF of yield from the agricultural transfer would lessen streamflow reductions on the South Platte River compared to Alternative 2 for Subalternative 4.1 or Alternative 3 for Subalternative 4.2.
Stream Morphology	Effects unlikely.	Reduced streamflows in the Poudre River would affect channel characteristics, particularly downstream of Fort Collins to Greeley.		
Reservoir Water Quality	None known.	None known.	Salinity could exceed 500 mg/L for early years of operation of Cactus Hill Reservoir.	Subalternative 4.1, none known. Subalternative 4.2, see Alternative 3.
Geology				
Dam site	No dam sites anticipated.	Fault in the vicinity of the Glade Reservoir dam may cause construction and seepage issues that would need to be addressed at final design.	No issue known.	Subalternative 4.1, see Alternative 2. Subalternative 4.2, none known.
Rock cut	No rock cuts anticipated.	Western alignment alternative for U.S. 287 would require an approximate 2,000-foot-long cut through a linear ridge that would require designs for rock reinforcement and catchment.	No rock cuts anticipated.	Subalternative 4.1, see Alternative 2. Subalternative 4.2, none known.
Soils				
Prime Farmland lost (ac)	Removal of irrigation from up to 69,200 acres of agricultural lands would affect a substantial area of Prime Farmland.	698	1,990	16,267 (4.1); 17,559 (4.2)
Vegetation				
Total lost (ac)	Up to 69,200 (irrigated).	3,900–3,942	6,237	3,321–3,355 (4.1); 5,650 (4.2)
Native plant communities lost (ac)	Effects to native plant communities would be minor.	2,705–2,807	2,191	2,301–2,318 (4.1); 1,703 (4.2)
Noxious Weeds	Major impacts-spread of noxious weeds has large potential due to the removal of irrigation, from up to 69,200 acres of agricultural lands.	Reservoirs would potentially reduce habitat for noxious weeds, but disturbance for construction and road relocation would create potential habitat for weeds.		Removal of irrigation from up to 17,137 acres of irrigated agricultural lands would likely increase the distribution of noxious weeds.
Wetlands (direct effects)	Loss of up to 1,384 acres.	Loss of 43 to 44 acres.	Loss of 79 acres.	Loss of 385 to 397 acres.
Wildlife				
Big game species	No distinguishing effect (NDE) ¹	NDE	NDE	NDE

Resource/Issue	Alternative 1 No Action	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Migratory birds and raptors, amphibians and reptiles, and other wildlife	NDE	NDE	NDE	NDE
Fish and Other Aquatic Life	NDE	NDE	NDE	NDE
Species of Concern				
Preble's meadow jumping mouse	No known effect to Preble's.	Loss of 50 acres of habitat and disturbance to 26 acres of habitat.	No known effect to Preble's.	Subalternative 4.1, see Alternative 2. Subalternative 4.2, NDE.
Bald eagle	No known effect to bald eagle.	About 0.9 mile of pipeline would be within 0.5 mile of a bald eagle nest, and portions of the pipeline would be located as close as about 250 meters from the nest site. Although pipeline construction impacts would be temporary, they could result in nest abandonment or decreased nesting success if conducted during sensitive breeding and nesting periods.	Less than 1 acre of habitat within 0.5 mile of a bald eagle nest would be temporarily impacted by modifications of the Poudre Valley Canal.	Impacts similar to Alternatives 2 and 3, depending on the reservoir.
Colorado butterfly plant	NDE	NDE	NDE	NDE
Ute ladies'-tresses orchid	NDE	NDE	NDE	NDE
Bell's twinpod	No known effect to Bell's twinpod.	Loss of 22 to 27 acres of Bell's twinpod habitat. Temporary impacts to 42 to 43 acres of Bell's twinpod habitat as a result of the western realignment.	No known effect to Bell's twinpod.	Permanent impacts similar to those from Alternative 2 or 3, depending on the reservoir.
Recreation Resources				
Flat water boating	No impacts to boating unless boating is allowed at gravel pits once used for water storage.	If Glade is managed for recreational uses, new boating opportunities may exist.	No public access is planned for Cactus Hill; therefore, boating would be unaffected.	Impacts to boating would be the same as Alternative 2 (Glade) or 3 (Cactus Hill), dependent upon the reservoir.
Moving water boating	Unlikely to affect boatable flows or reaches of the Poudre River.	Reductions in Poudre River streamflows below the mouth of the Poudre Canyon would affect boatable flows and reaches of the Poudre River.		
	No use of Munroe Canal.	Use of the Munroe Canal as a secondary diversion for Glade Reservoir could extend the boating season into August for the Filter Plant Run.	No use of Munroe Canal.	Subalternative 4.1 would be the same as Alternative 2.
Fishing	If gravel pits are stocked with fish, these sites may provide new fishing opportunities.	If Glade is managed for public recreation, it would provide a new sport fishery.	No public access is planned for Cactus Hill; therefore, there would be no sport fishery open to the public.	Impacts same as Alternatives 2 (Glade) and 3 (Cactus Hill), dependent upon the reservoir.

Resource/Issue	Alternative 1 No Action	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Hunting	Impacts to waterfowl habitat due to irrigated lands dry up may affect waterfowl hunting. Likely no impacts to hunting unless close enough to public lands where hunting is allowed to provide additional habitat for wildlife species.	430 acres of the Poudre River State Trust Land, which is managed for hunting and fishing by CDOW, would be inundated. However, construction of Glade Reservoir would potentially improve waterfowl habitat, therefore improving nearby hunting opportunities.	No public access is planned for Cactus Hill; therefore, there would be no effects to public hunting at the reservoir. However, construction of the reservoir may improve waterfowl habitat, therefore improving hunting opportunities at nearby lands.	Impacts to waterfowl habitat due to irrigated lands dry up may affect waterfowl hunting. Other impacts would be similar to Alternative 2 or 3, dependent upon the reservoir.
Other Recreation	No known effects to other recreation.	Construction of the Carter pipeline would temporarily disrupt use of the Foothills trail in several places and would temporarily impact the aesthetic qualities enjoyed by recreationists of parks and natural areas along the alignment. Construction of Carter or Glade to Horsetooth pipelines would temporarily disrupt other dispersed recreational uses along its alignment.	Construction of the Carter pipeline would potentially temporarily disrupt use of the Foothills trail in several locations and would temporarily impact the aesthetic qualities enjoyed by recreationists of parks and natural areas along the alignment.	Impacts would be the same as Alternative 2 or 3, dependent upon reservoir.
Cultural Resources	NDE	NDE	NDE	NDE
Aesthetics and Visual Resources	NDE	NDE	NDE	NDE
Traffic and Transportation				
Loss of roads	No known effects to roads.	Glade Reservoir would inundate about 7 miles of U.S. 287, which would be rerouted east of the reservoir.	Cactus Hill Reservoir would inundate portions of Weld County roads 19 and 90, which would need to be rerouted around the reservoir.	Subalternative 4.1, see Alternative 2. Subalternative 4.2, see Alternative 3.
Access	No known effects to access.	Glade Reservoir would inundate access to the State Trust land west of the reservoir, Bonner Spring Ranch Road, and Big Ridge Way.	None known.	Subalternative 4.1, see Alternative 2.
Land Use				
Conversion of irrigated agricultural lands to nonirrigated lands (ac)	69,200 (this is the maximum estimated impact).	0	0	17,137
Conservation of agricultural lands	Removal of irrigation from up to 69,200 acres of agricultural lands would substantially affect agricultural lands and productivity.	Approximately 60,000 acres of irrigated agricultural lands would be needed to remain in agriculture to facilitate the SPWCP, thus conserving agricultural lands and productivity.		Removal of irrigation from 17,137 acres of agricultural lands would affect agricultural lands and productivity.
Residences	None known.	None (District owns leased buildings).	11 private residences would be inundated and 9 additional homes are within 1,000 feet of the reservoir.	Subalternative 4.1, see Alternative 2. Subalternative 4.2, see Alternative 3.

Resource/Issue	Alternative 1 No Action	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Utilities	None known.	Power poles would need to be relocated with the realignment of U.S. 287.	PRPA powerlines would need to be relocated.	Subalternative 4.1, see Alternative 2. Subalternative 4.2, see Alternative 3.
Socioeconomics				
Recreation value added with public recreation	None known.	\$17,115,400	0	\$17,115,400 (4.1) \$0 (4.2)
Agricultural impacts from water transfers	Lost production value from reduced agriculture output under No Action represents about 4.5% of total agriculture output in the four-county region. Total economic impact is estimated to be a loss of approximately \$37.8 million annually.	No impact.	No impact.	Lost production value represents about 3.3% of total agriculture output in Larimer and Weld counties. Total economic effects are estimated to be a loss of approximately \$9.9 million annually.
Paleontology	None known.	Rock cut for the western realignment alternative for U.S. 287 involves the Morrison Formation, which is considered a highly fossiliferous geologic unit.	None known.	Subalternative 4.1, see Alternative 2. Subalternative 4.2, none known.
Hazardous Sites	None known.	The proposed Glade Reservoir forebay is located near the Atlas "E" Missile Site 13 and a known TCE plume associated with the missile site.	None known.	Subalternative 4.1, see Alternative 2. Subalternative 4.2, see Alternative 3.

¹No distinguishing effect (NDE) for this resource and alternative. The effects for this resource associated with the alternative do not help to substantially distinguish among the alternatives. This does not mean no effect.

4.2.2.1 Alternative 1—No Action

The No Action alternative would transfer irrigation water from about 33,637 acres to 69,200 acres of irrigated agricultural land to provide water to the Participants. The range in acreage affected by the transfer of agricultural water is influenced by the amount of headgate diversions and overall system efficiency, which can vary by irrigation ditch systems. The maximum potential acreage of agricultural lands affected by the transfer of irrigation water for M&I of 69,200 acres was used for impact assessment.

The transfer of irrigation water from up to 69,200 acres of irrigated agricultural lands to M&I use

primarily distinguishes Alternative 1 from the action alternatives, particularly Alternatives 2 and 3. This results in the No Action alternative having the greatest loss of wetlands (1,384 acres) and having the greatest effects on land use, Prime Farmland soils, and existing vegetation due to the changes that would occur to up to 69,200 acres of irrigated lands. The construction and operation of facilities associated with the No Action alternative would have minor environmental effects. The most common facilities associated with the No Action alternative are mined gravel pits converted to water supply reservoirs and conveyance pipelines. The majority of environmental effects would occur during aggregate mining prior to ownership by the

Participants and the subsequent reclamation and conversion to water supply reservoirs. Effects associated with pipelines would likely be temporary. The No Action alternative would rely primarily on the transfer of agricultural water to M&I use, so there would not be a net reduction in streamflows. However, it is likely that there would be new points of diversion for the transfer of water near the mouth of the Poudre Canyon where most of municipal providers have diversions, similar to the action alternatives. Diversion of the transferred agricultural water would reduce streamflows between the new diversion point higher on the Poudre River and the historical point of diversion. The impacts analysis assumes no new points of diversion. It is not known how much of the transferred water would be diverted at new locations.

4.2.2.2 *Alternative 2—Proposed Action—Glade Reservoir and the SPWCP*

Alternative 2 would cause the direct loss of 43 to 44 acres of wetlands, which is substantially less than Alternatives 1 and 4 (Table 4-6). Alternative 2 would cause a loss of 3,909 to 3,942 acres of vegetation, 2,705 to 2,807 acres of which is native vegetation. The total vegetation lost is the next lowest loss (lowest is Subalternative 4.1 with 3,321 to 3,355 acres); however, Alternative 2 has the greatest loss of native vegetation. Alternative 2 would have the least loss of Prime Farmland soils (698 acres). The construction of Glade Reservoir would cause the loss of 50 acres of Preble's meadow jumping mouse habitat and the disturbance of another 26 acres of habitat.

Glade Reservoir would use the existing Munroe Canal as a secondary point of diversion. Use of the Munroe Canal would provide additional flow in the Poudre River to the frequently used Filter Plant Run in August that would extend the boating season on this reach of the Poudre River. Glade Reservoir is

the only reservoir alternative that may have managed public recreation. Public recreation at Glade Reservoir is estimated to add about \$17,115,400 annually to the recreation value of the region.

Glade Reservoir would also inundate local access (Table 4-6). The construction of Glade Reservoir would require the rerouting U.S. 287, which is common to Alternative 2 and Subalternative 4.1. The other alternatives would not affect any U.S. roadways, but Alternative 3 and Subalternative 4.2 would affect Weld County roads as part of the construction of Cactus Hill Reservoir. The realignment of U.S. 287 would have a rock cut and associated impacts to paleontological resources that the non-Glade Reservoir alternatives would not have.

Glade Reservoir has the only dam site with known geologic issues. There is a known fault near the proposed dam location, which may cause construction and seepage issues that would need to be addressed in the final design.

4.2.2.3 *Alternative 3—Cactus Hill Reservoir and the SPWCP*

Alternative 3 would directly impact 79 acres of wetlands and would have the greatest losses of vegetation (6,237 acres) due to the surface area of Cactus Hill Reservoir. The Poudre Valley Canal would need to be lined to efficiently convey water to Cactus Hill Reservoir. Lining of the canal would eliminate the supportive hydrology from an estimated 47 acres of wetlands (included in the 79 acres of direct impacts). Cactus Hill Reservoir would be the largest of the reservoirs (180,000 AF) to offset higher evaporation rates on the plains and more shallow depths (relative to Glade Reservoir at 170,000 AF). The larger Cactus Hill Reservoir would require increased diversions from the Poudre River compared to Glade Reservoir.

Cactus Hill Reservoir would inundate 11 private residences and would occur within 1,000 feet of nine additional residences. None of the other alternatives (except Subalternative 4.2, which also includes Cactus Hill Reservoir) would inundate private residences.

Cactus Hill Reservoir also would inundate portions of Weld County roads that would need to be realigned around the reservoir. Cactus Hill Reservoir would have high-salinity water for the first few years of operation.

4.2.2.4 Alternative 4—Glade or Cactus Hill Reservoir and SPWCP and Agricultural Transfers

Alternative 4 has two subalternatives:

4.1 Glade Reservoir and SPWCP and Agricultural Transfers, and

4.2 Cactus Hill Reservoir and SPWCP and Agricultural Transfers.

Alternative 4 would have impacts between Alternative 1 and Alternative 2 (Subalternative 4.1) and Alternative 3 (Subalternative 4.2) (Table 4-7). Wetland losses would be substantially less than Alternative 1, but substantially greater than Alternatives 2 and 3. Alternative 4 would have a smaller Galeton Reservoir (20,000 AF), which would reduce vegetation losses at the Galeton Reservoir site, but the smaller size of Galeton Reservoir would be due to the transfer of irrigation water from 17,137 acres of irrigated agricultural lands. This would cause a change in vegetation and land use on 17,137 acres of agricultural lands. A smaller Galeton Reservoir would lessen reduced flows in the South Platte River compared to Alternatives 2 and 3.

Table 4-7. Summary of Wet, Average, Dry, and Excluded Years at Canyon Gage.

Category	Years
Excluded (extreme wet event)	1980, 1983 ¹
Wet	1951, 1957, 1961, 1965, 1970, 1971, 1973, 1974, 1978, 1979, 1984, 1986, 1995, 1997, 1999
Average	1952, 1958, 1959, 1962, 1967, 1968, 1969, 1975, 1982, 1985, 1988, 1990, 1991, 1993, 1996, 1998
Dry	1950, 1953, 1955, 1956, 1960, 1963, 1964, 1966, 1972, 1976, 1981, 1987, 1989, 1992, 1994
Excluded (extreme dry event)	1954, 1977

¹Years in bold indicate the years in which the simulated Grey Mountain water right diversions occur. Simulated SPWCP exchange diversions into Glade or Cactus Hill reservoir and simulated SPWCP diversions from the South Platte River into Galeton Reservoir occur in all modeled years.

EFFECTS ADDRESSED BY RESOURCE

The following sections describe the effects of the alternatives on each resource evaluated.

4.3 SURFACE WATER

This section describes how the changes in flows for the action alternatives were estimated and what changes are expected to occur. Changes to the flows of the Cache la Poudre River and the South Platte River drive the impacts analysis for a variety of resources including aquatic resources, riparian resources, wetlands, water quality, stream morphology, and recreation.

4.3.1 Methods

MODSIM, a modeling tool, was used to simulate hydrology for the Poudre Basin, including the historical operation and administration of the major direct flow and storage water rights and the District's Poudre water rights. As part of the NISP EIS development, HDR reviewed the Poudre Basin MODSIM network. The network was examined for inclusion of all key diversions (both agricultural and M&I), storage facilities, exchanges, and other important operational features (HDR 2005a, 2005b).

HDR (2007a) used output from the Poudre Basin MODSIM network(s) to generate streamflow data for use in the various impacts analyses. Ten river reaches (nine on the Poudre, one on the South Platte), represented by the following flow links in the MODSIM network, were studied (listed in upstream-to-downstream order:

- CANGAGE (USGS gage at canyon mouth)
- MAIN3 (between Hansen Canal and Pleasant Valley and Lake Canal)
- MAIN6 (between New Mercer and Larimer No. 2 ditches)
- LINCAGE (USGS gage near Lincoln Street)
- MAIN12 (between Timnath Inlet Canal and Boxelder Ditch)
- MAIN14 (between Fossil Creek Inlet and Fossil Creek)
- MAIN18 (just below Jones Ditch)
- MAIN20 (just below Boyd Ditch)
- GRLYGAGE (USGS gage near Greeley)
- KRSGAGE (USGS gage near Kersey)

For each flow link, the following parameters were evaluated on a wet/average/dry year basis:

- Baseline (pre-project) flow
- Project flow (post-project implementation)
- Change in flow

- Percent change in flow

The results were presented as monthly averages over the 1950–1999 study period (Appendix A).

4.3.1.1 Model Selection and Development

The MODSIM river network modeling tool was selected for use in the surface water hydrology modeling for the NISP EIS. Riverside Technologies, Inc. (RTi) of Fort Collins was contracted by the District to develop a Poudre Basin MODSIM network application for NISP in the early 2000s.

RTi and the District added NISP features to the baseline network to create project networks. Together, the baseline and project networks are used to compare Poudre and South Platte river flows before and after NISP implementation.

The MODSIM model network developed for the Poudre Basin is comprehensive, extending from the headwaters of the river to its confluence with the South Platte River near Kersey, Colorado. Modeling of the Poudre Basin is dynamic, with available water supplies allocated on the basis of the Prior Appropriation Doctrine.

The model network also incorporates a South Platte River component that reaches from just above the Poudre-South Platte river confluence to Julesburg, near the Colorado-Nebraska state line. Senior direct flow water rights on the South Platte River were modeled statically; that is, the model is designed to satisfy the historical diversion record for these downstream ditch systems. In this manner, the MODSIM model accounts for all potential senior water right calls that may “pull” water down the Poudre River into the South Platte River Basin.

The Poudre Basin MODSIM model includes approximately 660 nodes and 850 links. Actual basin features in the model network, represented by

the many links and nodes, include approximately 120 direct flow water rights and 50 mountain and plains reservoirs.

4.3.1.2 Model Study Period

The study period for the NISP EIS Poudre Basin MODSIM application covers the 50-year period beginning November 1, 1949 and ending October 31, 1999 (irrigation years 1950–1999). The model runs on a monthly time step over the course of the study period. The study period includes drought periods (1954–1956, 1977) as well as wet years (1957, 1978–1980, 1983).

NISP is designed to withstand a drought equivalent to the 1950s drought. This is consistent with other water suppliers in the region, and acceptable to the Participants. In the time period studied for NISP, the harshest drought on record occurred in the Poudre Basin from 1953–1956, which lasted 4 years, a total deficit of 437,500 AF, and is representative of a 1-in-50 year event (Resource Consultants 1985; Frick et al. 1990).

Although a consensus has not been determined as to a return period for the early-2000s drought, it is likely to be substantially greater than a 1-in-50 year event and, therefore, beyond the proposed design for NISP.

4.3.1.3 Data Analysis

MODSIM output data was divided into wet, average, and dry years by month (Table 4-7). Classification of years within the NISP study period (1950–1999) as wet, average, or dry was based on an analysis of synthesized natural flows at the canyon gage.

Model simulations were conducted using the MODSIM tool, as reviewed by HDR (2005a) and accepted by the Corps for use in the NISP EIS. HDR developed an Excel spreadsheet template to compare the pre- (baseline) and post-project flows.

The results of the model runs are summarized in Appendix A.

4.3.1.4 Gage Height

The rating tables for the following gages were used to convert flow data to gage height (or stage, if an offset is provided):

- Cache la Poudre River at mouth of canyon near Fort Collins (USGS 06752000)
- Cache la Poudre River at Lincoln Street in Fort Collins (USGS 06752260)
- Cache la Poudre River near Greeley (USGS 06752500)
- South Platte River near Kersey (USGS 06754000)

HDR also developed an Excel spreadsheet template for generating the gage height data. Linear interpolation in the rating tables was used to convert baseline and project flow data to gage height data, which were used to determine the potential effect of reduced flows to wetland and riparian vegetation and stream morphology. All four gage height parameters (baseline, project, change, percent change) are reported in a summary file (Appendix A).

4.3.1.5 Modeling of Agricultural Transfers Alternatives

Alternative 4 would combine Glade Reservoir or Cactus Hill Reservoir with a reduced-capacity SPWCP and would transfer agricultural water to municipal use. Galeton Reservoir would have a capacity of about 20,000 AF. Approximately 12,000 AF of consumptive use (CU) agricultural water would be transferred to municipal use. The Larimer-Weld Irrigation Canal and the New Cache Ditch (a.k.a. Greeley No. 2) were conceptually identified as the most feasible sources of agricultural transfer water at the scale necessary for a regional project such as Alternative 4.

Based on average diversions per acre irrigated under the two ditch systems, about 17,150 acres of irrigated farmland would need to be “dried up” as a condition of the proposed agriculture-to-municipal transfer. Under Alternative 4, NISP would have three important quantities to manage: 1) 12,000 AF of CU water that is transferred from agricultural to municipal use; 2) 9,450 AF of nonconsumptive water that is acquired as part of the overall water rights purchase, but that must be returned to the stream consistent with historical patterns; and 3) about 17,150 acres of formerly irrigated farmland.

4.3.1.6 Deliveries and Exchanges

The Poudre Basin MODSIM networks were used to quantitatively assess impacts to surface waters as a result of implementation of NISP. The model superimposes proposed NISP diversions and exchanges on historical hydrology and existing basin operations. Impacts to the Poudre River are estimated by comparing results of pre- (baseline) and post-project flows in key river reaches. As the model network is presently constructed, water is diverted at the Poudre Valley Canal headgate when NISP water rights are in priority. This water is then routed either directly into storage or routed directly to fulfill NISP demands. The model does not represent any releases from the NISP storage reservoir back to the Poudre River to meet the requirements of exchanges necessary to deliver water to the project Participants (Section 2.3.3).

The Water Resources Technical Report (HDR 2007b) includes analyses of the delivery exchanges and alternate points of diversion that are primarily qualitative in nature. For example, the District is currently proposing to use the Munroe Canal as a secondary point of diversion during times when the downstream water quality is diminished, and to make deliveries to several of the Project’s northern Participants through the Pleasant Valley Pipeline

(Brouwer 2006). Similarly, the proposed NISP exchanges with C-BT facilities to deliver water to the southern Participants would result in reduced C-BT water being delivered to the Poudre River through the Hansen Canal; and in exchange, NISP would release a like amount of water from Glade Reservoir to the Poudre River.

The Munroe Canal diversion and delivery exchanges are not represented in full detail in the Poudre Basin MODSIM network. As a result, the impacts analyses include quantitative results to the extent that estimated long-term average annual distributions of diversions, deliveries, and streamflow impacts were developed. The distributions illustrate the potential magnitude of impacts to the Poudre River resulting from the delivery of the Participants’ water. If the Corps authorizes the project, it would include permit conditions limiting diversions and exchanges based on descriptions of project operations provided by the District and the associated analyses completed by the EIS team.

4.3.2 Effects Common to All Action Alternatives

The effects common to all of the action alternatives associated with diversions from the Cache la Poudre and South Platte rivers were discussed in Section 4.2. All of the action alternatives would reduce flows in the Cache la Poudre River below the Poudre Valley Canal (near the mouth of Poudre Canyon) when the Grey Mountain water right is in priority, and all the action alternatives would reduce flows in the South Platte River below its confluence with the Poudre River when the SPWCP water rights are in priority (Appendix A). Flows in the Poudre River would also be reduced in the reach between the Poudre Valley Canal and the Larimer-Weld Canal

and/or New Cache Ditch headgates when the SPWCP exchanges are operational.

4.3.2.1.1 Streamflows

The greatest percentage of reductions in average monthly streamflow on the Poudre River would occur in May, June, and July. Percentage reductions in streamflow would be greatest at the Lincoln Street gage in May in an average year (71.3 percent for Alternative 2 and 74.5 percent for Alternative 3) (Table 4-2 and Appendix A). Percentage reductions in streamflows in the South Platte River at the Kersey gage would be greatest in June of average years (14.9 percent for Alternative 2 and 15.4 percent for Alternative 3).

HDR also generated a series of flow-duration curves for each of the 10 MODSIM links for each action alternative. A flow-duration curve illustrates the relationship between flow rate and the probability that the flow rate will be equaled or exceeded at a given location. The simulation time interval is monthly; therefore, the flow-duration curves indicate the likelihood that a given monthly average flow rate will be equaled or exceeded. In general, increasing flow rates correspond to decreasing probability of exceedance.

The total annual flow-duration curves for the CANGAGE link under baseline (non-NISP) conditions for Alternative 2 are shown as an example in Figure 4-2. Modeled baseline (non-NISP) flows are shown in blue and projected flows are in pink. Additional flow-duration curves are provided in Appendix A.

Figure 4-2, which incorporates the full modeled streamflow record at the canyon gage for Alternative 2, suggests that there would be virtually no impacts to Poudre streamflow at this location when flows are below about 250 cfs. Above that rate, streamflows would generally be lower than the existing condition. This is consistent with the junior priority

of the NISP water rights and the consequent ability to typically divert only during periods of high flow.

4.3.2.1.2 River Surface Elevations

Reductions in river surface elevations (depth) associated with reductions in flows are also presented in Appendix A. The greatest percent of reductions in river surface elevations would occur in June of wet years on the Poudre River at the Lincoln Street gage (1.66 feet for Alternative 2 and 1.77 feet for Alternative 3), and on the South Platte River at the Kersey gage (0.32 feet for Alternative 2 and 0.33 feet for Alternative 3).

4.3.2.1.3 Reservoir Levels

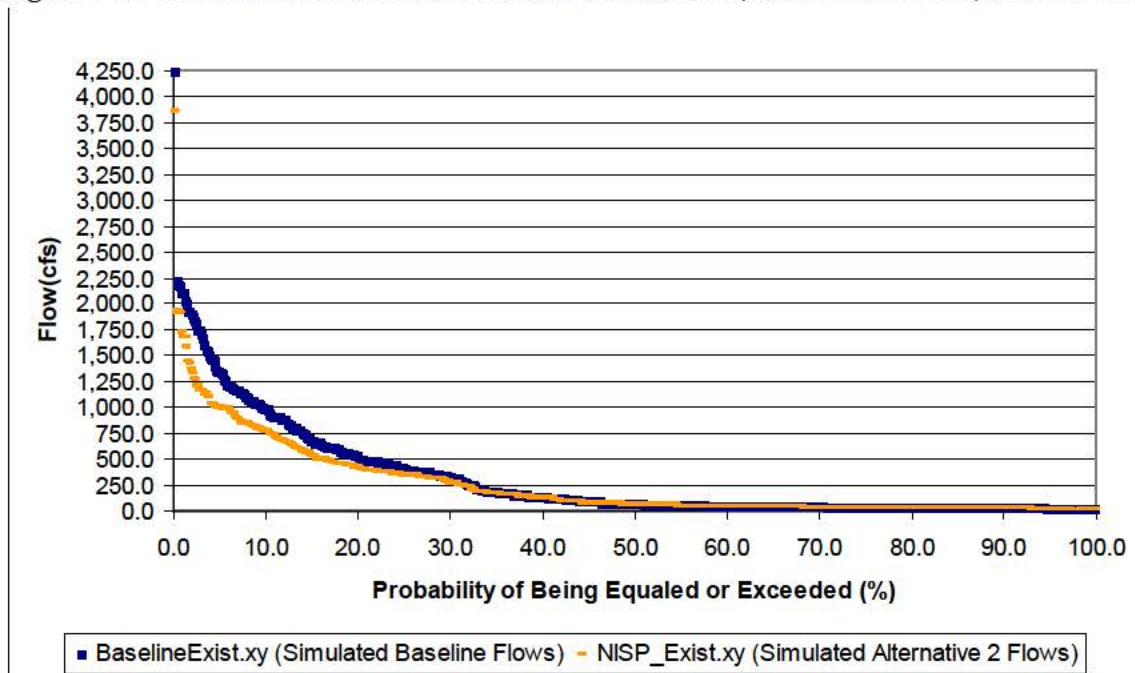
Reservoir levels for Glade, Galeton, and Cactus Hill reservoirs were estimated for the historical study period (1950–1999) to estimate how the water surface elevations may fluctuate under operating conditions.

Time series plots illustrating the results for Alternatives 2 and 3 are provided in Figure 4-3 and Figure 4-4. The water surface elevations at full pool (170,000 AF for Glade; 180,000 AF for Cactus Hill; 40,000 AF for Galeton) are also shown on each plot.

Under either Alternative 2 or 3, Galeton Reservoir would completely fill almost every year in the 50-year study period. Annual drawdown in Galeton would closely resemble annual SPWCP exchange volumes. Glade and Cactus Hill reservoirs would rarely fill to their maximum capacities.

Under Subalternative 4.1 (Glade plus SPWCP plus Agricultural Transfers) and Subalternative 4.2 (Cactus Hill Reservoir plus SPWCP plus Agricultural Transfers), fill and drawdown patterns for the primary storage reservoir (Glade or Cactus Hill reservoir) should be similar to those shown in Figure 4-3 and Figure 4-4. This is because the transferred agricultural water rights would still have to be diverted during the irrigation season, the same

Figure 4-2. Overall Flow-Duration Curve for Alternative 2, Link CANGAGE, IY 1950–1999.



time period as the SPWCP exchanges that are effectively being replaced. Annual patterns at Galeton Reservoir would also be similar because SPWCP exchanges would continue to operate, albeit at a lesser volume, but elevations would be adjusted to reflect the reservoir capacity being reduced to approximately 20,000 AF.

4.3.3 Alternative 1—No Action Alternative

The hydrologic impacts due to implementation of the No Action alternative cannot be quantified. Under the No Action alternative, the firm yield demands of the Participants could be met by some combination of the following:

- Transfers of agricultural water to municipal use
- Purchase of additional C-BT units
- Increased well production with augmentation (transferred senior agricultural water)

In the case of agricultural transfers, measures would be required in the adjudication process to ensure no injury to other water users on the various streams and rivers. The Participants would be required to continue historical diversion and return flow patterns. There could be some changes in streamflow to the Poudre River if downstream agricultural water rights are transferred upstream to M&I diversion points. It was assumed that the current points of diversion would not change, due to the inability to predict where changes would occur.

The purchase of C-BT units and the relocation of their place of use is a common practice within the boundaries of the District. Because C-BT water is transmountain water, this process is permitted without mitigating any changes in flow experienced by downstream water users. Depending on how the units are relocated, there could be minor localized increases or reductions in the flows of stream reaches, but on balance, changes in flows would be negligible.

Figure 4-3. Estimated Water Surface Elevations for Glade Reservoir (top plot) and Galeton Reservoir (bottom plot), Alternative 2, 1950–1999.

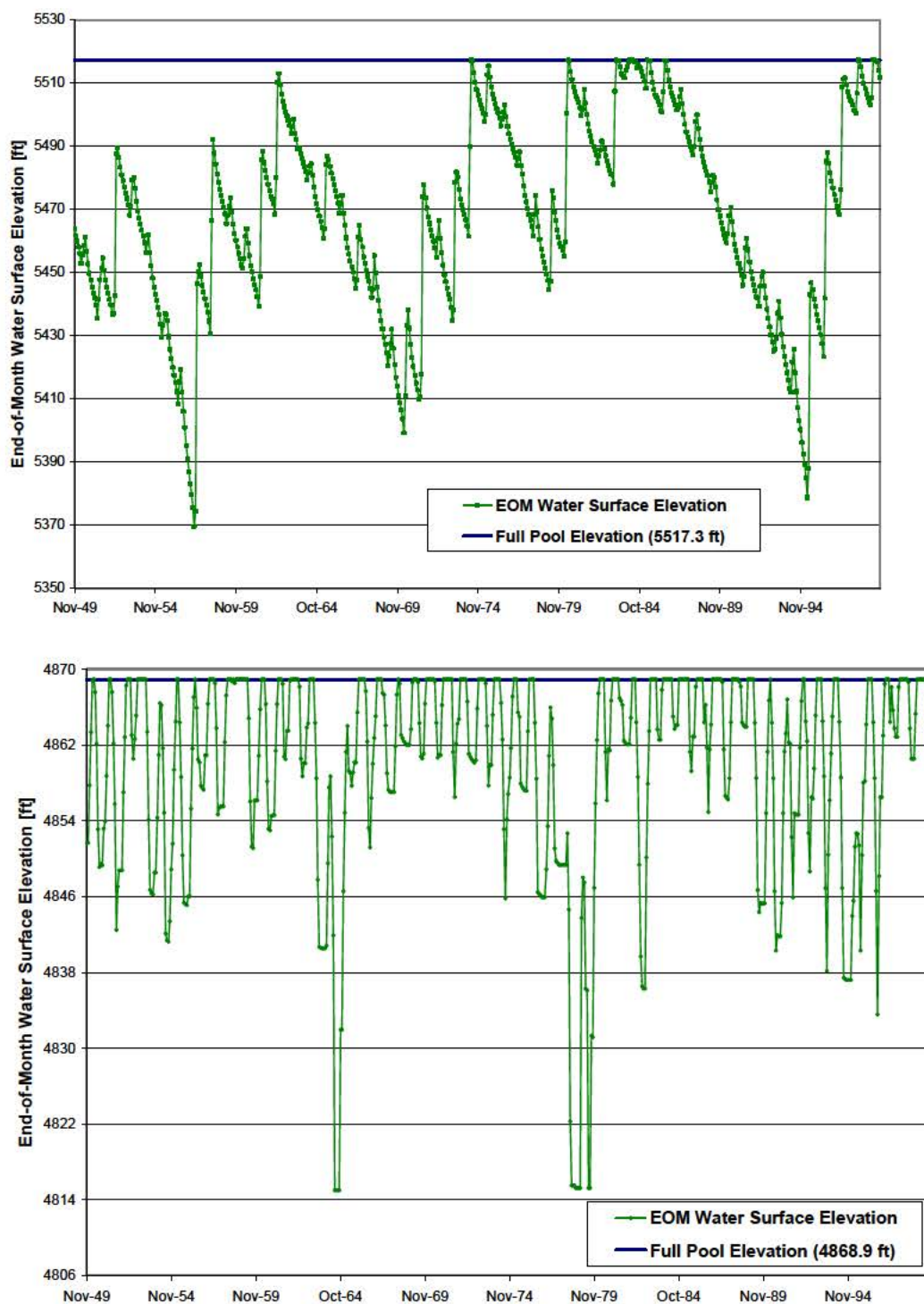
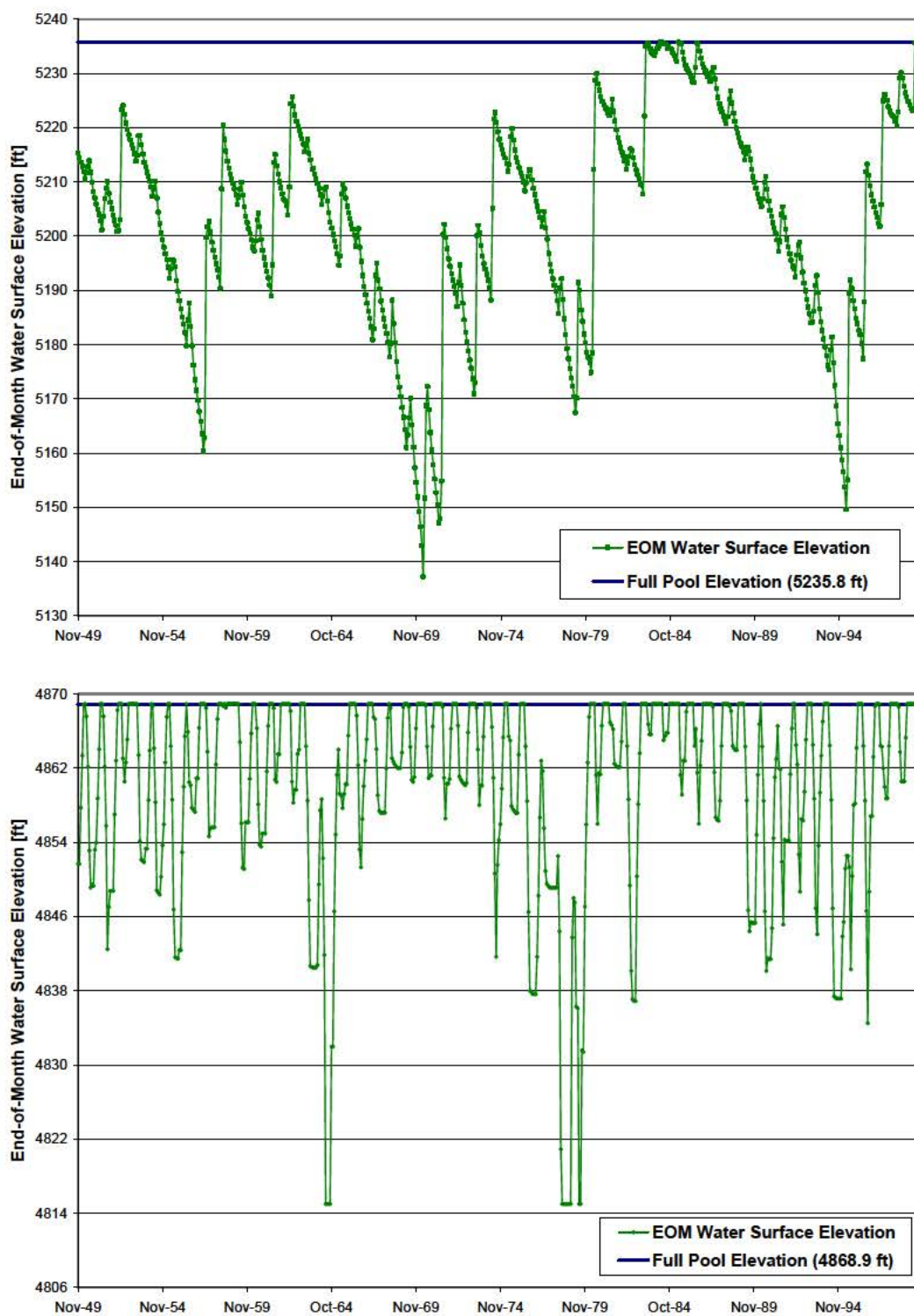


Figure 4-4. Estimated Water Surface Elevations for Cactus Hill Reservoir (top plot) and Galeton Reservoir (bottom plot), Alternative 3, 1950–1999.



Municipal well pumping from the South Platte River alluvium by Fort Morgan and Fort Lupton would likely occur out-of-priority because new wells would have very junior water rights. As a result, these entities would need to acquire senior agricultural water to augment South Platte River flows. This process mitigates impacts due to the increased well pumping. Acquisition and transfer of agricultural water for augmentation purposes would require maintenance of the existing return flow regime to avoid injury to other water users.

The conversion of gravel pits to water storage reservoirs would require water to augment evaporation losses from the gravel pits, and would therefore mitigate any effects to streamflows.

The No Action alternative would allow other holders of water rights junior to the District's Grey Mountain water right for NISP to seek a permit to divert the flows and it is unknown what the impact on the Poudre River flows would be, but it is likely that the flows in the Poudre River would be reduced under a different water right in the future.

4.3.4 Alternative 2

As described in Section 4.2.1.1, the Proposed Action would reduce flows in the Poudre River and South Platte River. The greatest reductions in average monthly flows on a percentage basis would occur in May through August on the Poudre River at the Lincoln gage in Fort Collins (Appendix A). Average monthly flow reductions during these months would range from 32 to 71 percent, depending on the type of water year (wet, average, or dry) (Appendix A). Flow reductions would also occur on the South Platte River, with the greatest estimated reductions in average monthly flows occurring in June (5 to 15 percent reduction) and during late fall and winter (3 to 9 percent reduction) as measured at the Kersey gage (Appendix A).

4.3.5 Alternative 3

The substitution of Cactus Hill Reservoir for Glade Reservoir in Alternative 3 will further increase flow reductions due to the larger size of Cactus Hill Reservoir (180,000 AF) to compensate for greater evaporation on the plains and transport losses. Flow reductions for Alternative 3 in wet and average years when more water is available for diversions, would be about 3 to 6 percent greater than Alternative 2 during the months of peak flow reductions on the Poudre River and about 0.5 to 1 percent greater on the South Platte River (Appendix A).

4.3.6 Alternative 4

Alternative 4 would involve a reduced Galeton Reservoir (20,000 AF) by using 12,000 AF of transferred agricultural water to comprise a portion of the yield from the SPWCP. This would reduce flow reductions in the South Platte River by about 1 percent during the summer and 2 to 5 percent during the winter relative to Alternative 2 (Subalternative 4.1 with Glade Reservoir) and Alternative 3 (Subalternative 4.2 with Cactus Hill Reservoir).

4.3.7 Mitigation

The mitigation of reduced streamflows is addressed under each of the resources affected by reduced streamflows.

4.4 STREAM MORPHOLOGY

The following effects are described for the action alternatives, which have similar effects on flows. The No Action alternative would involve almost no changes in streamflows, assuming no changes in points of diversion. The No Action alternative is estimated to have no effect on stream morphology. All of the action alternatives (Alternatives 2, 3, and

4) would reduce flows in the Poudre and South Platte rivers, as described in Sections 4.2.1.1 and 4.3.

4.4.1 South Platte River

The period of high spring runoff flows in the South Platte River has historically begun in May and peaked in mid-June. Bankfull and greater flows are most likely to occur during this time. NISP's maximum pump capacity at the South Platte River intake is 200 cfs, which is lower than the average flows of 500 to 700 cfs that occur during much of the year at the Kersey gage.

Channel-forming flows (1.5-year peak flows of 3,858 cfs) would occur or be exceeded about 3 percent of the time. Under the action alternatives, flows of this magnitude would occur less than 1 percent of the time. High flows of up to about 24,200 cfs were modeled to occur under baseline conditions; flows exceeding about 22,600 cfs would not occur under the action alternatives. Scouring flows equivalent to the 25-year peak flows would continue to occur in the South Platte River under the alternatives. It is unlikely that implementation of NISP would affect the morphology of the South Platte River downstream of the confluence with the Poudre River. Additional information on the channel morphology of the South Platte River can be found in the South Platte River Near Kersey Stream Morphology Technical Report (ERO 2008h).

4.4.2 Cache la Poudre River

The period of high spring runoff flows in the Poudre River has historically begun in May and peaked in mid-June. Bankfull and greater flows are most likely to occur during this time. At the Canyon gage, channel-forming flows (1.5-year peak flows of 1,988 cfs) would be exceeded about 1 percent of the

time under the action alternatives, or about 2 percent less than under existing conditions. High flows of up to 5,300 cfs were modeled to occur under baseline conditions; flows exceeding about 4,000 cfs would not occur under the action alternatives. At the Lincoln Street gage, channel-forming flows (1.5-year peak flows of 891 cfs) would be exceeded almost 2 percent of the time, or about 2 percent less than under existing conditions. High flows up to 4,600 cfs were modeled to occur under existing conditions; flows exceeding about 3,250 cfs would not occur under existing conditions. At the Greeley gage, channel-forming flows (1.5-year peak flows of 736 cfs) would be exceeded slightly more than 1 percent of the time under the action alternatives, or about 2 percent less than under baseline conditions. For flows exceeding 3,000 cfs (scouring flows), flows would be reduced under the action alternatives by about 1,350 cfs.

Diversion from the Poudre River would typically be in the range of 800 to 1,200 cfs. NISP's maximum pump capacity at the Poudre Valley Canal is 1,000 cfs. The average rate of diversion is estimated to be 1,000 cfs. The average pumping rate could only be accomplished during spring high flows when the District's Grey Mountain water right is in priority. Average daily high flows exceeding 1,000 cfs have historically occurred for about 37 days, mostly in June. Based on high flow data collected at the canyon gage from 1950 through 2004, flows of 1,000 cfs or more would not occur during nearly 4 percent of all years and would occur for 14 days or less during nearly 19 percent of all years. Flows of 1,000 cfs or above have occurred for 60 days or more during nearly 13 percent of all years; during those years, such flows typically occurred from mid-May through mid-July. During years when flows equaled or exceeded 1,000 cfs, a withdrawal of 1,000 cfs would have reduced the flow of the river below the Poudre Valley Canal by at least 50 percent

during nearly 75 percent of the time when such withdrawals could be made.

A number of short segments of the Poudre River dry up during the irrigation season and/or during the winter months. A review of the impacts of the proposed NISP diversions on the dry-up points showed that for all but one location, impacts would be minimal. The District has agreed to curtail diversions when river flows are in the range of specified minimum flows, so dry-up points near Watson Lake and below the Fossil Creek Reservoir inlet would be mitigated. The District has proposed measures to mitigate flow reductions at the Fossil Creek inlet dam (Section 5.1.1). At the winter dry-up points, particularly the Little Cache/Terry Lake inlet, Larimer-Weld Canal headgate, and Timnath Reservoir inlet, the potential exists for NISP/SPWCP exchanges to reduce the number of days of river dry-up at these locations. However, because the water would simply be diverted upstream to Glade or Cactus Hill Reservoir, the net impact may be no change to the winter dry-up points. At the Canal 3 and Ogilvy Ditch dry-up locations near Greeley, the percent changes in river flow as a result of the NISP alternatives would be very small except in May and June. South Platte River augmentation plans would likely pull water downstream past these two points, minimizing dry-up.

Existing conditions do not represent static conditions. In addition to short-term adjustments in the river channel, there is evidence that the river continues to adjust to the combination of past and present changes to the channel and the watershed. The overall effect of the action alternatives throughout the study area would be that morphologic and sediment transport processes that depend on moderately high flows (typically in the 500 to 3,000 cfs range) would become less dominant. Processes that occur at lower flows would not be significantly

affected by the action alternatives, nor would processes that occur during the rare large floods. The impacts of the changes that would result due to streamflow changes under the action alternatives would vary from reach to reach and are described for each reach.

4.4.2.1 Laporte Reach

Although this is where streamflow changes would be the greatest, sediment transport and river morphology in this reach would generally be the least affected in the study area because the streambed through this reach is well armored and is stable except during very large flood flows (Anderson 2008). The reach would be expected to be relatively insensitive to changes in moderately high streamflows. Impacts would be increased channel stability, reduced mobility of bed material, less breakage of the channel armor layer, and less bank erosion. This could result in a gradual minor encroachment of vegetation into the stream channel. Major floods would still occur in this reach, with resultant effects.

4.4.2.2 Fort Collins Reach

This is a highly variable reach and a variable response to the action alternatives would be expected. There are areas where moderately high streamflows contribute to channel maintenance by scouring fine material and limiting vegetation encroachment. In these depositional areas (such as upstream of Mulberry Street), acceleration in channel contraction would be expected and channel capacity reduced. This could change the effects of flooding during high flows and accelerate bank erosion during floods. Aside from flood conditions, the alternatives would be expected to increase bank stability because reduced magnitude and duration of high flows would reduce the mobility of bed materials and reduce breaking of channel armoring

(Anderson 2008). In nondepositional areas, minor vegetation encroachment would be expected to increase slightly on channel margins and bars.

4.4.2.3 *Timnath, Windsor, and Greeley Upstream Reaches*

Although these reaches vary somewhat, the dominant morphological and sediment deposition processes are the same. Responses to the action alternatives would be expected to be similar. Reduced flows from historical and existing diversions have encouraged sedimentation and reduced opportunities for channel rejuvenation. Return flows from irrigation and wastewater treatment plants provide a constant supply of water and, in some cases, sediment, that promote sediment deposition and support in-channel vegetation. Existing flushing flows are not of sufficient frequency, duration, and magnitude to completely overcome the combined sedimentation-vegetation effect, which results in channel contraction, especially in the Windsor and Greeley upstream reaches. The action alternatives would be expected to further accelerate channel contraction. Reduced flows would also decrease opportunities for scouring and channel rejuvenation. The action alternatives may increase sedimentation in some parts of the Greeley Upstream Reach and decrease sedimentation in other parts of that reach. Little change in the rate of sedimentation is expected in the Timnath and Windsor reaches. Increased bank erosion may occur as a secondary effect of the acceleration of sediment deposition, but is not expected to be significant because at the present, there are only isolated cases of minor bank erosion in these reaches that are already highly impacted by human activities.

4.4.2.4 *Greeley Channelized and Greeley Downstream Reaches*

These two reaches are already highly modified and while the same processes of sediment deposition and vegetation establishment occur as in upstream reaches, the existing process is not as rapid. It is expected that the effects of the action alternatives would not be as great as in the reaches immediately upstream.

4.4.2.5 *Summary of Effects to the Cache la Poudre River*

From the canyon mouth to Fort Collins, the action alternatives would be expected to increase bed and bank stability, but episodic erosion would still occur in response to large flood events. Some channel contraction would be expected in deposition zones. The most significant impacts of the action alternatives on stream morphology and sediment transport would be expected to occur between Fort Collins and Greeley. The existing process of channel contraction via sediment deposition and vegetation encroachment would be expected to be accelerated. In Greeley and downstream to the South Platte River confluence, the same process would be expected to continue, but the effect of the action alternatives would be smaller. Additional information on the channel morphology of the Cache la Poudre River can be found in the River Morphology and Sediment Transport Technical Report for the Cache la Poudre River (Anderson 2008).

4.4.3 Mitigation

While it is likely that changes to stream morphology and sediment transport would occur in the Poudre River, there is uncertainty in the extent of change that would occur and in the timing of changes. Large-scale changes are already underway in the

Poudre River as the result of historical water resources development and other development in the watershed. Further impacts attributable to the chosen NISP action alternative would be additive to the impacts that already drive change. Impacts from NISP would likely be progressive rather than sudden, could occur over decades, and may be small compared to changes that are already occurring. These considerations do not lead to a recommendation for an immediate set of mitigation actions. Instead, they suggest that the optimum course of action is a detailed river monitoring program leading to a long-term adaptive management program. The monitoring program should be initiated with a detailed inventory of each reach and identification of sites that should be monitored for change. Monuments could be established to collect data necessary to track changes in the river channel. Vegetation transects can be established to monitor the distribution, density, and diversity of vegetation species. Photographic documentation should be obtained during each data collection effort. A project geographical information system should be developed as an integral part of the monitoring program. The components of the adaptive management program would rely on the data collected during the monitoring program. The adaptive management program should be considered a toolbox of mitigation measures that could be accessed depending on the monitoring efforts. Depending on the type, nature, and extent of the impact at each site, several mitigation measures may be available to mitigate project impacts. These mitigation measures may include, but are not limited to, the following:

- Accelerate establishment of channel forming by managing in-channel or riparian vegetation;
- Place structures to direct sediment to selected aggradation zones;

- Install check structures or weirs to control the inundation of riparian vegetation;
- Regulate flows and utilize exchanges to promote the increase in water level to support adjacent riparian vegetation and other river attributes;
- Install measures to reduce sediment inflow from drains or tributaries;
- Manage flows to provide flushing in selected river reaches; and
- Place measures in areas subject to bed and bank erosion.

4.5 SURFACE WATER QUALITY

Public and agency scoping identified potential water quality changes in the Poudre River and the quality of water that would be stored in the proposed reservoirs as concerns. This section addresses water quality in the Poudre River, South Platte River, Horsetooth Reservoir, and water quality for each of the proposed reservoirs.

4.5.1 Methods

The potential effects of the NISP alternatives on streamflows were estimated using the Poudre Basin MODSIM model network (HDR 2007a). The model study period was the 50-year period from 1950 to 1999. The MODSIM network simulations are run on a monthly time step. Flow changes in the Poudre River between the Munroe Canal headgate and the Horsetooth Reservoir delivery point that could result from diversions from the Munroe Canal rather than the Poudre Valley Canal were not modeled using the MODSIM model network. Flow increases were estimated based on an evaluation of changes to C-BT diversions from the Munroe Canal that would occur if Glade Reservoir were constructed.

The analysis of water quality impacts to the Poudre River upstream of Shields Street in western Fort Collins and of the South Platte River downstream of the Poudre River was completed by reviewing existing water quality data at various flow rates to determine how various water quality parameters might change due to changes in flows. Changes in the water quality of the Poudre River due to flow reductions at the locations of WWTP outfalls, resulting in less dilution of WWTP effluent in the river, were estimated by completing mass balance calculations at locations in the river below the WWTPs. Changes in the water quality of Horsetooth Reservoir due to deliveries from the Glade-to-Horsetooth or Cactus Hill-to-Horsetooth pipelines were estimated by completing mass balance calculations for Horsetooth Reservoir.

The water quality of the proposed Glade Reservoir was estimated by Lewis (2003) by completing a mass balance analysis using the known water quality of the two water sources for the reservoir and considering the morphometry and operating conditions of the reservoir. Because reservoirs in northeast Colorado are generally fairly saline, a model of Cactus Hill Reservoir was completed that provided the estimated salinity of the reservoir (ERO 2008j). The concentrations of other water quality parameters in Cactus Hill Reservoir were evaluated qualitatively based on the known water quality of the water sources and the morphometry and operating conditions of the reservoir. The water quality of the proposed Galeton Reservoir was evaluated qualitatively based on the known water quality of the water source for the reservoir and the morphometry and operating conditions of the reservoir.

4.5.2 Effects Common to All Action Alternatives

Water quality effects to the Poudre River and South Platte River resulting from flow changes in the rivers would be similar under all of the action alternatives because the flow changes would be similar between alternatives. In the Poudre River, the largest flow decreases that would occur in late spring and early summer may increase stream temperature and nutrient concentrations, but changes in metal concentrations may not be measurable. Because the highest total organic carbon (TOC) concentrations have always occurred during high flows and the lowest concentrations have occurred during low flow periods, it is expected that reduced streamflows would likely reduce TOC concentrations. Selenium concentrations in the Poudre River have been highest at low flow and may increase due to reduced streamflows. In the South Platte River, the largest flow reduction that would occur in June could increase stream temperature by a few degrees and increase nutrient and sulfate concentrations.

The piping of water from either Glade or Cactus Hill Reservoir would likely not impact the water quality of Horsetooth Reservoir negatively. The quality of either Glade or Cactus Hill reservoirs would be good for domestic water use and the reservoirs would be operated to prevent transferring poorer quality to Horsetooth Reservoir. Galeton Reservoir, which would store water for agricultural use, would have poorer quality water, but could be used for irrigation.

4.5.3 Cache la Poudre River

4.5.3.1 No Action Alternative

It is not possible to accurately determine the specific mix of future water sources that would be acquired by the Participants because the process of acquiring water supplies would be driven by many factors.

While there may be water quality effects to surface water resources due to the water transfers, changes in points of diversion and storage in gravel pit lakes, it is not possible to estimate such effects.

4.5.3.2 Action Alternatives

Under Alternatives 2 and 4, water would be diverted from the Poudre River near the canyon mouth and perhaps also from higher in the river at the Munroe Canal diversion point to be stored in off-channel Glade and Galetton reservoirs. Under Alternatives 3 and Subalternative 4, water would be diverted from the Poudre River near the canyon mouth to be stored in off-channel Cactus Hill and Galetton reservoirs. From the Munroe Canal diversion to the canyon mouth (approximately 6 miles of the river), the flow increases predicted to occur during the summer and fall would likely improve the water quality of the river as a result of increased dilution by mainstem water that is lower in dissolved solids concentrations than North Fork water, slightly reduced stream temperatures and increased dissolved oxygen concentrations. The small flow decreases predicted to occur in May and June are not expected to affect stream water quality.

Changes in the water quality of the Cache la Poudre River from the canyon mouth eastward are of most concern where Greeley diverts water for municipal use near the canyon mouth, where the river changes from being capable of supporting some cold water aquatic life to supporting some warm water aquatic life (at Shields Street on the west side of Fort Collins) and at the six locations where wastewater treatment plants discharge effluent directly to the Poudre River or to a tributary to the river.

At the canyon mouth, flow decreases during the spring and summer months could result in stream temperatures exceeding the chronic standard more frequently and in dissolved oxygen concentrations

being less than the spawning standard more frequently. It is not expected that the concentrations of other water quality parameters, which are generally low, would increase under the action alternatives. At Shields Street, temperature and dissolved oxygen concentrations could be similarly affected, and nitrate and pH concentrations could exceed standards more frequently due to reduced streamflows. Increased stream temperatures and pH would increase unionized ammonia concentrations.

The uppermost wastewater treatment plant on the Poudre River is the City of Fort Collins WWTP near Lincoln Street and the lowest is City of Greeley's WWTP east of Greeley. With streamflow reductions, total ammonia concentrations in the river would increase below all of the WWTPs; however, ammonia concentrations up to a certain concentration are efficiently removed or transformed as the water moves downstream. Stream temperatures would likely increase due to decreased flows, which would increase unionized ammonia concentrations and could reduce oxygen diffusion to the water column, potentially enhancing biological activity in the river. While this could result in decreased nutrient concentrations in the river, it could create problems associated with increased algal biomass in the river. TOC concentrations would be expected to decrease due to reduced streamflows, while selenium concentrations may increase. Predicted changes in metal concentrations (increases and decreases) in the Poudre River due to NISP are expected to be small and may not be measurable.

4.5.4 South Platte River

The largest flow decreases are predicted to occur in June and January. The reduced flow of about 275 cfs in June in an average year could result in a temperature increase of several degrees, but the

standard would not be exceeded. Unionized ammonia concentrations would increase in June, but the total ammonia standard would likely not be exceeded more frequently. The phosphorus concentration, which already always exceeds the EPA recommended concentration for streams, would likely increase slightly. Sulfate concentrations could more often exceed the standard in June. The reduced flow of about 80 cfs in January in an average year would likely result in slightly colder water, could raise the ammonia concentration slightly (not to above the total ammonia standard), could raise the phosphorus concentration slightly, and could raise the sulfate concentration slightly.

4.5.5 Horsetooth Reservoir

Under Alternative 2, it is estimated that the average annual volume that would be pumped through the Glade-to-Horsetooth pipeline would be 2,600 acre-feet, with a maximum annual volume of about 7,000 acre-feet. Deliveries of water from Glade to Horsetooth would occur primarily during January through March, when the average storage of water is about 115,000 acre-feet (USBR 2007). Given that the average inflow would be about 2 percent of the average total storage volume during delivery, or about 6 percent during maximum delivery, and that the expected Glade Reservoir nutrient, dissolved solids, total organic carbon and chlorophyll concentrations are lower or only slightly higher than Horsetooth Reservoir concentrations, it is expected that the water quality of Horsetooth Reservoir would not be negatively affected by inflows from Glade Reservoir. Manganese concentrations sometimes exceed the standard in Horsetooth Reservoir and could be elevated in Glade Reservoir when the reservoir level is low; however, Glade Reservoir could be operated to avoid manganese releases from

the bottom or by avoiding the release of deeper waters when the lake is drawn down.

4.5.6 Glade Reservoir

Under Alternatives 2 and 4, Poudre River water would be diverted near the canyon mouth and would supply approximately 99 percent of the water reaching the proposed Glade Reservoir. The remainder of the Glade Reservoir water would be supplied through runoff in the watershed (Lewis 2003; HDR 2007c). The projected long-term quality of water in Glade Reservoir would be good, comparable to major domestic water supply reservoirs currently being used by municipalities along the Front Range. No specific water quality problems are anticipated for the reservoir with the possible exception of manganese release under low dissolved oxygen conditions. When the reservoir is drawn down significantly, the water quality could be impaired.

4.5.7 Cactus Hill Reservoir

Under Alternative 3 and Subalternative 4, Poudre River water would be diverted near the canyon mouth and would supply nearly all of the water reaching the proposed Cactus Hill Reservoir. Runoff from the watershed might supply 2 to 3 percent of the water supply to the reservoir, especially when large storm events occur and/or during wet years (ERO and HDR 2008).

Many reservoirs on Colorado's eastern plains have high salinity concentrations (Ficke and Danielson 1973). A model was developed to estimate potential salinity concentrations associated with water that would be stored in the proposed Cactus Hill Reservoir (ERO 2008j). Model results predict the salinity of the proposed Cactus Hill Reservoir to be initially high during the first few years (up to 500

mg/L), in large part due to the salts currently present within the surface soils in the basin. However, modeled operational practices of the reservoir, combined with the large quantity and low salinity of the supply water diverted from the Poudre River, are predicted to leach the salts out of the reservoir basin over an 8-year period, resulting in long-term reservoir salinity concentrations averaging about 50 mg/L. It is assumed that the high quality water from the Poudre River canyon mouth would be piped or transported via a lined ditch to Cactus Hill Reservoir so that no salts would be added to the water supply during transport.

Cactus Hill Reservoir would be larger, but shallower, than Glade Reservoir. It is expected that the quality of the reservoir would be good because the sources of water to the reservoir would be of good quality. Anoxic conditions may occur toward the end of the summer near the bottom of the reservoir. A release of manganese from the lake bottom could occur when dissolved oxygen concentrations are low, but this could be reduced or eliminated by aerating the deepest part of the lake or by using a multiple-outlet withdrawal structure that would draw water from the shallower part of the reservoir during the last half of the summer.

4.5.8 Galeton Reservoir

Under all of the action alternatives, Galeton Reservoir would be used to store water withdrawn from the South Platte River at the confluence with the Cache la Poudre River. The quality of the river at this location is poor because it consists primarily of irrigation and municipal return flows during all but the late spring to early summer runoff period. It is expected that the quality of Galeton Reservoir would be similar to that of the river. The reservoir may contain elevated nutrient and dissolved solids concentrations. The reservoir may experience

anoxia and algal blooms, particularly at low water levels.

4.5.9 Mitigation

From the mouth of Poudre Canyon to the west side of Fort Collins, where the Poudre River is cold enough throughout the year to support trout populations and cold water invertebrates, water quality impacts and impacts to aquatic life that would occur during the winter months could be mitigated by increasing winter flows by 10 cfs or more. Diversions of water from the Poudre River could be timed, reduced or avoided during periods of hot weather and/or when the river temperature is chronically above a temperature at or above 20°C at key locations for cold water aquatic life. This would likely be during July, August, and the first week of September. River diversions for the Project could be taken only during the coolest part of the day, from approximately midnight to mid-morning.

To mitigate water quality effects that may occur from Fort Collins to the mouth of the Poudre River, advanced wastewater treatment may be required to meet effluent limits at lower flows and warmer stream temperatures. In addition, agricultural return flows could be treated prior to discharge to the Poudre and South Platte rivers.

To prevent negative impacts to the water quality of Horsetooth Reservoir due to delivery of water from either Glade or Cactus Hill reservoir, the reservoirs could be operated to avoid manganese or nutrient releases from the lake bottom or by avoiding the release of deeper waters when the lake is drawn down by using a multiple outlet withdrawal structure. Water quality issues that might exist in Glade or Cactus Hill reservoir during the filling phase could be avoided in Horsetooth Reservoir by not delivering water to Horsetooth Reservoir until

the water quality in Glade or Cactus Hill reservoir reaches its long-term equilibrium.

4.6 WATER RIGHTS

The District's Poudre and SPWCP conditional water rights are an integral part of all of the action alternatives. Water rights for NISP are discussed in Section 3.6.

4.6.1 Effects Common to All Alternatives

The alternatives would not adversely affect existing water rights. The action alternatives rely on the Grey Mountain and SPWCP water rights, which have been adjudicated in state water court. The adjudication process and water right decrees ensure that water rights senior to the Grey Mountain and SPWCP water rights would not be adversely affected by the District's exercise of the water rights associated with NISP.

4.6.2 Alternative 1

The No Action alternative would involve the transfer of agricultural water rights to M&I use. The transfers would be required to be adjudicated in state water court and the adjudication process and transfer decrees would protect senior water rights, as well as historical return flows associated with the agricultural water rights being transferred. The No Action alternative would allow the holders of water rights junior to the District's Grey Mountain water right for NISP to seek permits to divert the flows that would have been diverted by NISP.

4.6.3 Alternative 2

There would be no effect on water rights associated with Alternative 2.

4.6.4 Alternative 3

There would be no effect on water rights associated with Alternative 3.

4.6.5 Alternative 4

Alternative 4 would involve the transfer of agricultural water rights to M&I use. The transfers would be required to be adjudicated in state water court and the adjudication process and transfer decrees would protect senior water rights, as well as historical return flows associated with the agricultural water rights being transferred.

4.6.6 Mitigation

No impacts to water rights are estimated to occur with the alternatives and mitigation is not proposed for water rights.

4.7 GROUND WATER

The effects of the proposed reservoirs on ground water were an issue expressed during public scoping. This section discusses ground water at the proposed reservoir locations and along the Cache la Poudre and South Platte River watersheds within the project area.

4.7.1 Methods

Existing information on geology and ground water resources, as well as the NISP modeling results and the Water Quality Technical Report (ERO and HDR 2008), were used to determine potential effects to

ground water resources associated with the proposed reservoir locations, the Cache la Poudre River and the South Platte River within the study area.

4.7.2 Glade Reservoir

Based on the geology of the proposed reservoir area and well data from the SEO, the alluvium in the proposed reservoir area is most likely dry and is not currently being used as a water supply. The reservoir design requires that alluvium in the footprint of the impoundment be removed and grout curtains installed to minimize seepage beneath the dam. Seepage from the reservoir would enter the generally dry alluvium downstream of the dam and would be available to wetlands created for impact mitigation.

The reservoir is designed to minimize seepage. Features designed to minimize seepage include a grout curtain, concrete cutoff walls, seepage barrier, and removal of all alluvium beneath the dam (GEI 2006a). At the reservoir site, the surficial material overlying the bedrock is less than 50 feet thick (GEI 2006a). Some amount of seepage would occur and likely would reach bedrock units. However, it is unlikely to negatively impact ground water users in the area because the quality of the reservoir water likely would be higher than existing bedrock water quality. Seepage from the reservoir could increase available bedrock ground water downgradient of the reservoir.

The TCE ground water plume located near the proposed Glade Reservoir is described in detail in Section 3.23.3. The toe of the plume is located within the Lyons Formation beneath the proposed location of the forebay. Within the toe of the plume, TCE concentrations are below Colorado Basic Ground Water Standards (CBGWS). Slightly upgradient of the footprint of the proposed forebay, TCE concentrations are slightly above CBGWS.

Should seepage from the reservoir enter the Lyons Formation, the direction of ground water flow may change from southeast to southwest because of the hydraulic head created by the impoundment. Should this occur, the toe of the TCE plume may also change flow directions from southeast to southwest. Given the already low TCE concentrations in this portion of the plume, there would be no impacts to ground water. If seepage enters the Lyons Formation, there would be additional dilution of the already low TCE concentrations. Because seepage from the reservoir would either follow topography downstream of the dam and/or move down a structural dip in the bedrock units, the source area for the TCE plume would not likely be affected by the reservoir.

4.7.3 Galeton Reservoir

Plans for the proposed Galeton Reservoir indicate that most of the existing surficial material would be excavated during construction of the reservoir to be used in the construction of the dam. Surficial material includes soil, alluvium, wind deposits, and residual or weathered bedrock, and is generally less than 12 feet thick in the reservoir area (Section 3.7.3). These deposits are unsaturated and would mostly be removed and, therefore, would not be affected with respect to ground water by construction of the reservoir. Surficial deposits downstream of the reservoir may receive water as a result of seepage beneath the dam, but there are currently no known users of alluvial ground water in the vicinity of the proposed reservoir. Potential impacts would be limited to increasing soil moisture to vegetation along the various normally dry drainages downgradient of the dam. However, the dam design should minimize losses due to seepage.

The relatively low hydraulic conductivity of the Laramie Formation bedrock would also limit the

amount of seepage through the bottom of the reservoir. Small seepage losses may occur through fractures or more permeable sandstones. Although it is unlikely that positive impacts would be significant, any reservoir water that infiltrates into the bedrock would increase the amount of water available to ground water users downgradient of the reservoir.

The quality of ground water in the vicinity of Galetton Reservoir is poor due to elevated dissolved solids and nutrient concentrations. Ground water quality below and downgradient of the reservoir would not be further degraded due to seepage from the reservoir because the reservoir water quality would probably be better than the ground water quality in that area.

4.7.4 Cactus Hill Reservoir

Surficial material near the proposed Cactus Hill Reservoir is between 0 and 15 feet thick and may be removed during construction of the impoundment (Section 3.7.2). Current ground water use in this area is limited to bedrock aquifers located beneath the surficial material (SEO Records). As with the other proposed reservoirs, Cactus Hill Reservoir would be constructed to minimize seepage from the impoundment. However, minimal seepage would enter dry surficial material downstream of the reservoir or bedrock beneath the impoundment. There may be positive impacts to water quality and water quantity because the quality of water in the reservoir would be better than that of area ground water and because more water may become available to wells near the reservoir. However, such positive impacts would depend on the actual amount of seepage.

Anheuser-Busch currently has a permit for land application of brewery wastewater at agronomic rates. This means that water can be applied to soil

only to the extent that cultivated plants can use the water. Anheuser-Busch is required to monitor surface water discharge, ground water, and soil water via lysimeters. The Water Quality Control Division (WQCD) stipulated in the permit that ground water concentrations of nitrate plus nitrite must not exceed 100 mg/L (an agricultural standard), compared to the drinking water standard of 10 mg/L. The WQCD reports that the land application system has been operated very well by Anheuser-Busch. However, the permit-required ground water monitoring would not prevent degradation of ground water with respect to the drinking water standard for nitrate. The discharge permit requirements may be adequate for current use of the property and for current ground water use, but if the area were to be used for a reservoir, nitrate and other compounds could be mobilized by higher ground water flow rates due to seepage from the impoundment unless these soils are removed during construction of the impoundment.

4.7.5 Cache la Poudre River

The portion of the Cache la Poudre River within Poudre Canyon below the Munroe Canal Diversion would be subject to reduced peak spring flows because of increased diversion at the Munroe Canal. The canyon portion of the river is incised in bedrock with relatively thin alluvium and, therefore, is likely to be a “gaining” stream. Ground water discharge from bedrock to the river is probably small because of the low hydraulic conductivity of the bedrock, but the ground water flow direction is most likely toward the river. Ground water in the thin alluvium within the canyon variably receives water from the river and discharges water back to the river, depending on the nature of the hydraulics within each reach of the stream. The anticipated small changes in stage due to decreases in flow are not

expected to impact ground water in the alluvium and surrounding bedrock.

Downstream of the Poudre Canyon, between the canyon mouth and the confluence with the South Platte River, calculated stage changes as a result of Alternatives 2 and 3 would range from zero to a maximum of 1.77 feet (for the month of June during a wet year for Alternative 3 at the Lincoln gage). During average years, the maximum stage change for both alternatives would be about 1 foot. In this reach of the Poudre River, alluvium is relatively thick (at least 75 feet thick based on SEO records) and up to 1 to 2 miles wide. Numerous ground water wells along the Poudre River produce water from the alluvium for irrigation, domestic, and stock purposes. Production rates range from a few gallons per minute (gpm) for domestic wells to 1,000 gpm for irrigation wells.

During periods of high river flow (spring runoff) for this reach of the Poudre River, the river likely recharges alluvium adjacent to the river. As high flows decrease and irrigation of adjacent fields increases during the summer months, ground water probably flows toward the river. There is insufficient information to determine whether the river is gaining or losing during the winter months. It is probable that certain portions of the river receive ground water due to the delay in ground water flow from irrigated fields some distance from the river, and there may be neither recharge nor discharge to the alluvium in other portions of the river.

The maximum calculated stage changes for the portion of the river near the Lincoln and Greeley stream gages may reduce the rate of recharge to alluvium during periods of higher flow. The alluvium would still be recharged by the river during the spring, but the lowered stage (1 to 1.77 feet) would reduce the head gradient and, therefore, the

rate of ground water flow through the alluvium near the river (less than 100 feet from river). Alluvium 100 feet or more from the river would not be as affected as alluvium adjacent to the river because of longer ground water travel time and flatter hydraulic gradients away from the river. Also, much of the recharge to alluvium away from the river may be dominated by precipitation and irrigation.

The reduction in stage during periods of higher flow would probably not impact ground water users along the river. The largest stage changes are predicted to occur during periods of highest flow, which generally occurs during June, prior to significant irrigation pumping. It is highly unlikely that the stage changes during high flow periods would significantly change the volume of water that normally recharges the alluvial aquifer. However, as irrigation pumping increases and river flow decreases into July and August, it is possible that “dry up points” could increase in size or length, depending on the proximity to large-scale irrigation pumping. The reduced river flows associated with the action alternatives may make the Poudre River more susceptible to impacts from alluvial pumping along the river. Assuming alluvial ground water pumping would remain relatively constant in the future, pumping would become a larger percentage of the total amount of water flowing down the drainage as both surface and ground water and, therefore, would have a larger impact on the river.

There would be no negative effects to ground water quality in the canyon below the Munroe Canal. The Cache la Poudre throughout its reach likely recharges the alluvium during peak flow periods (typically May and June). Predicted changes in stream water quality that would occur downstream of the canyon during May and June may also occur in alluvial ground water. However, as a result of chemical and biochemical interactions between ground water and the geological materials through

which it flows, ground water contains a wide variety of dissolved inorganic chemical constituents at various concentrations (Freeze and Cherry 1979). Changes to ground water quality as a result of changes in stream water quality due to the NISP alternatives would be temporary and may not be separable from the existing variability in ground water quality. During periods of low flow (such as July and August), the river alluvium most likely gains water from irrigation supported alluvial ground water that moves from farm fields toward the river channel. Any predicted changes in river water quality during low river flows would likely not have an affect on alluvial ground water quality.

4.7.6 South Platte River

The stage changes for the action alternatives along the South Platte River are predicted to be small (up to 0.33 feet). A stage change of 0.33 feet is small compared to typical fluctuations in ground water levels of several feet. Given this, it is unlikely that there would be measurable impacts to alluvial ground water along the South Platte River.

There could be slight changes in water quality in the South Platte River due to increased surface water diversions under the NISP alternatives. The predicted slight changes in surface water quality may not measurably affect alluvial water quality or be separable from natural water quality variability in the alluvium.

4.7.7 Mitigation

Effects to ground water associated with any of the action alternatives are estimated to be minor and mitigation is not proposed.

4.8 GEOLOGY

Geology was raised during scoping relative to dam location and design for the proposed reservoirs. The discussion in this section focuses on the two areas of known potential geological issues: the proposed Glade Reservoir Dam and the proposed cut through the hogback associated with the western realignment alternative for U.S. 287.

4.8.1 Methods

The evaluation of geological issues was based on existing information in a preliminary assessment of the proposed Glade Dam site (GEI 2006a).

4.8.2 Effects Common to All Alternatives

Most of the effects to geology associated with the alternatives would be minor associated with ground-disturbing construction activities. The construction of the dam for Glade Reservoir and road cut for the western realignment alternative for U.S. 287 have potentially significant geologic issues and effects and are described below.

4.8.3 Glade Reservoir Dam

Three prominent inactive faults are mapped near the proposed Glade Reservoir site—the Bellvue Fault, the Livermore Fault, and the North Fork Fault. The Livermore Fault, which was once hypothesized to be potentially active, is now considered to be inactive (GEI 2006a). Shear zones associated with faults near the proposed dam may cause issues regarding the construction and performance of the proposed dam such as poor rock quality and potential seepage paths through the foundation.

The Lykins Formation occurs in the Glade Reservoir area and has been the subject of several geotechnical investigations at nearby Horsetooth Reservoir involving reservoir seepage through one or more of its limestone, gypsum, or anhydrite subunits contained in the lower 250 feet of the formation (GEI 2006a). In addition, during construction of Horsetooth Reservoir, voids and joints within the Sundance Sandstone Formation, identified in the central valley section of the Glade Reservoir site, were suspected of diverting drilling waters during foundation grouting. These voids and soft siltstone and clays were overexcavated during the foundation construction (GEI 2006a).

Additional information concerning the foundation soils and bedrock conditions will be evaluated. These issues will be addressed in the final design, including a grouting program and other foundation treatment precautions.

4.8.4 U.S. 287 Western Realignment Rock Cut

The U.S. 287 western realignment alternative associated with Alternative 2 involves a cut through a linear rock ridge trending approximately north-south with sedimentary rock striking with the ridge and dipping to the east between 12 and 25 degrees. The eastern exposure of the cut is sandstone of the Lytle Formation, which is estimated to be a maximum of 80 feet thick and a minimum of approximately 50 feet thick, with a weighted average of approximately 60 feet thick. Underlying the Lytle Formation and exposed on the west side of the ridge is the Morrison Formation. The interface between the Lytle and Morrison Formations was assumed to dip at 14 degrees to the east. The Morrison Formation is characterized primarily by claystone with some sandstone layers.

Rock excavation and cut slopes would be required as the alignment traverses west through the existing ridge west of the Holcim property. The proposed road cut is planned to penetrate completely through the ridge and would be approximately 2,000 feet long, a maximum of 220 feet deep, and a maximum of 880 feet wide. The side slopes are estimated to be between 2H:1V and 1H:1V depending on the location and ground type. These inclinations are required for slope stability. Some rock reinforcement also may be required. It is expected that rockfall would be addressed with a combination of rock reinforcement, rockfall screen, and catchment ditches. Excavation of the rock cut is expected to require a combination of blasting and ripping. Preliminary design of the cut is for the side slopes to be 1H:1V in the Lytle Sandstone and 2H:1V in the Morrison Formation. The specific design of these cut slopes would be developed during final design.

4.8.5 Mitigation

Additional geotechnical studies will be performed as needed if Alternative 2 is permitted to aid in the final design of Glade Dam and the realignment of U.S. 287. Additionally, the visual effects of the rock cut associated with the western alignment would be mitigated as described in Chapter 5.

4.9 SOILS

The loss of agricultural land has been a trend in the region. The continued loss of agricultural lands and Prime Farmland soils was raised as an issue during scoping. The evaluation of the effects to soils focused on the permanent loss of Prime Farmland soils. Losses of Prime Farmland soils are presented by reservoir alternative because dam construction and inundation by the proposed reservoirs is the

action that would cause a loss of Prime Farmland soils.

4.9.1 Methods

Losses of Prime Farmland soils were assessed by reviewing the existing mapping of Prime Farmland soils by the NRCS in Larimer and Weld counties (NRCS 2007) relative to permanent aboveground project features or changes in management that would displace or change Prime Farmland soils.

4.9.2 Effects Common to All Action Alternatives

Galeton Reservoir is common to all of the action alternatives. See Section 4.9.5 for a description of losses of Prime Farmland soils associated with Galeton Reservoir.

4.9.3 Alternative 1—No Action

A substantial portion of the soils converted to dryland crop production or rangeland would likely contain Prime Farmland soils. Of the 572,640 acres of irrigated lands surveyed in 2002 in Larimer, Weld, Morgan, and Boulder counties combined, the conversion of soils to dryland crop production would result in an 11 percent decrease in all irrigated lands (USDA NASS 2007). Although some of these soils may remain productive, without irrigation some of the soils may no longer be considered Prime Farmland soils.

4.9.4 Glade Reservoir Site

In the Glade Reservoir study area, 243 acres of Prime Farmland would be permanently affected and 52 acres of Prime Farmland would be temporarily affected. The level of permanent impacts would be

minor, considering the impacts would be 0.001 percent of all Prime Farmland in Larimer County (NRCS 2007).

4.9.5 Galeton Reservoir Site

At 40,000 AF, the proposed Galeton Reservoir would inundate about 455 acres of Prime Farmland, and at 20,000 AF, the reservoir would inundate about 329 acres of these soils. This is less than 0.001 percent of all Prime Farmland in Weld County and, therefore, is considered a minor impact.

4.9.6 Cactus Hill Reservoir Site

Cactus Hill Reservoir would permanently affect 1,535 acres of Prime Farmland. This equals about 0.001 percent of all potential Prime Farmland in Weld County and, therefore, is considered a minor impact.

4.9.7 Alternative 2

Losses of Prime Farmland soils would be about 698 acres associated with Glade and Galeton reservoirs.

4.9.8 Alternative 3

Losses of Prime Farmland soils would be about 1,990 acres associated with Cactus Hill and Galeton reservoirs.

4.9.9 Alternative 4

Losses of Prime Farmland soils would be about 572 acres for Subalternative 4.1 (Glade Reservoir and Galeton Reservoir at 20,000 AF) and 1,864 acres for Subalternative 4.2 (Cactus Hill and Galeton reservoirs at 20,000 AF). As part of Alternative 4, irrigation would be removed from about 17,137 acres of irrigated agricultural lands. These lands

would likely be converted to dryland crops or rangeland. Although some of the soils may remain productive, without irrigation some of the soils may no longer be considered Prime Farmland soils.

4.9.10 Mitigation

Direct losses of Prime Farmland for the action alternatives are minor amounting to less than 0.1 percent of the Prime Farmlands in the respective counties in which the impacts would occur. No mitigation is proposed for the loss of Prime Farmland soils. Temporary impacts to soils would be minimized through construction BMPs described in Chapter 5.

4.10 VEGETATION

This section summarizes the potential effects to vegetation associated with the alternatives. Potential vegetation effects include the direct and indirect effects of proposed project facilities such as reservoirs and associated structures and their operation; and roads, pipelines, and canals. Figures 3-10 through 3-13 show the vegetation cover types at the Glade Reservoir study area, the Galeton Reservoir study area, the Cactus Hill Reservoir study area, and the U.S. 287 realignment study area.

4.10.1 Methods

Effects to vegetation were evaluated quantitatively where possible, using GIS mapping. Methods for evaluating vegetation effects are described in the Vegetation Technical Report (ERO 2008a).

Vegetation effects include benefits or positive effects resulting from the alternatives, as well as adverse impacts. Vegetation effects are described as “minor,” “moderate,” or “major” based on the following criteria. “Minor” is used when the

benefits or impacts would be short-term, occur at low levels, and are not likely to have a long-term noticeable effect on vegetation. Minor effects include temporary impacts during construction. “Moderate” is used when benefits or impacts would be noticeable, and the existing vegetation would likely be replaced by a different vegetation type. Moderate also includes losses of low or moderate quality vegetation types, such as disturbed areas, and introduced vegetation. Moderate effects typically are long-term. “Major” is used when impacts to large areas of native vegetation would occur. Major effects typically are long-term. The term “no impact” is used when there are no changes to existing conditions from the alternatives.

4.10.2 Effects Common to All Alternatives

4.10.2.1 Temporary Vegetation Disturbance

All of the alternatives would result in temporary disturbances to vegetation from construction of dams, spillways, conversion of gravel pits, roads and other facilities; and pipeline installation. Temporarily impacted areas would be revegetated following construction according to a revegetation plan. Species composition in revegetated areas may differ from current conditions. This is a minor short-term effect on vegetation.

4.10.2.2 Change in Existing Reservoir Water Levels

The Reclamation No Contract subalternatives would not result in changes in water levels at Horsetooth Reservoir and Carter Lake. In general, all of the Reclamation Contract subalternatives would result in changes in water surface levels at Horsetooth Reservoir throughout the year and during the growing season. Historically, Horsetooth Reservoir has fluctuated up to 55 feet. Fluctuations that would

occur under the Reclamation Contract Subalternatives would fall within the existing dead and conservation pools, and would be similar to the existing fluctuations. Simulated end of month (EOM) modeling showed that under existing conditions, the EOM water surface elevation varies between about 5,375 and 5,430 feet (HDR 2007b). Under the NISP modeling, the EOM water surface elevation would have the same variation. The vegetation types bordering Horsetooth Reservoir include upland and riparian species not dependent on lake levels. Changing water levels at Horsetooth Reservoir are unlikely to substantially affect vegetation for any of the alternatives because reservoir fluctuations would fall within the historical operations of the reservoir. In addition, the water surface elevations in the reservoirs currently fluctuate considerably as part of reservoir operations. Existing shoreline vegetation developed in response to fluctuations in water surface elevations is supported by multiple water sources. The changes in water levels at Horsetooth Reservoir would have a minor long-term effect on vegetation.

NISP would lower the EOM water surface elevation of Carter Lake slightly. Simulated EOM modeling showed that under existing conditions, Carter Lake varies between about 5,699 and 5,758 feet; with NISP, EOM would vary between 5,696 and 5,756 feet. The difference in EOM water surface elevation between existing conditions and NISP conditions are expected to generally be 1 to 2 feet, although all fluctuations would fall within the existing dead and conservation pools. For the same reasons stated above for Horsetooth Reservoir, it is unlikely that changes in the Carter Lake water surface elevation would affect shoreline vegetation around Carter Lake. The changes in water levels at Carter Lake would have a minor long-term impact on vegetation.

4.10.3 Alternative 1—No Action

Under the No Action alternative, existing gravel pits along the Cache la Poudre River, the South Platte River, the Big Thompson River, and Boulder Creek would be developed (HDR 2007b). For the impacts assessment it was assumed that impacts to vegetation would occur with the extraction of aggregate from the pits (an action not undertaken by the Participants) and that the pits would be converted to water supply reservoirs for the No Action alternative once the mining was complete. Therefore, the impacts to vegetation associated with the construction of gravel pit storage for the No Action alternative are attributed to the aggregate mining operations. There likely would be some minor additional impacts to vegetation at the gravel pit sites associated with construction of project features (such as inlet and outlet structures), but these have not been quantified. Under the No Action alternative, temporary impacts would occur associated with construction of pipelines and maintenance to existing canals and ditches (these temporary impacts have not been quantified).

It is estimated that up to 69,200 acres of agricultural land would be dried up under the No Action alternative. These agricultural lands likely would include irrigated agricultural crops such as corn, beets, alfalfa, and hay. This alternative would change the land use and vegetative cover from irrigated agricultural crops to rangeland and other upland vegetation, and would have a moderate long-term effect on vegetation.

4.10.4 Direct Impacts to Vegetation under the Action Alternatives

Table 4-8 lists the direct impacts to vegetation that would occur under the action alternatives. The greatest area of permanent impacts to vegetation

would occur under the action alternatives that involve agricultural transfers (Subalternatives 4.1 and 4.2). Agricultural transfers would result in the loss of 17,137 acres of Agricultural Transfer Lands. In addition, Subalternative 4.2 would impact about 5,650 acres of vegetation and Subalternative 4.1 would impact about 3,350 acres of vegetation (ERO 2008a). Impacts to vegetation under Alternative 4, including the subalternatives, would range from about 20,463 acres to about 22,795 acres, and are considered major long-term effects.

Alternative 3 (Cactus Hill plus SPWCP) would have the greatest losses of vegetation. Impacts to native vegetation communities, which are of higher quality than mixed vegetation communities, would be greater at Glade Reservoir than at Cactus Hill Reservoir because Glade Reservoir would involve impacts to about 863 acres of upland native grasslands and about 458 acres of upland native shrublands, for a total of 1,321 acres of native grasslands and shrublands. Cactus Hill Reservoir would involve impacts to about 872 acres of upland native grasslands. Galetan Reservoir, included in all of the action alternatives, would involve impacts to 1,335 acres of upland native grasslands. Impacts to vegetation under Alternatives 2 and 3 are considered major long-term effects.

4.10.5 Mitigation

To the extent practicable, impacts to vegetation would be minimized during final design and construction of the project once a final alternative is selected. Mitigation for impacts to vegetation would include revegetating areas temporarily disturbed during construction, and revegetating project features such as dam embankments, road cut and fill slopes, and agricultural transfer lands following construction.

4.11 NOXIOUS WEEDS

The distribution and control of noxious weeds is an issue of concern throughout the region. Construction and land use changes can increase the distribution of noxious weeds. Because all of the alternatives are likely to increase the distribution and cover by noxious weeds, the potential effects of the alternatives are addressed as effects common to all alternatives.

4.11.1 Methods

The potential for noxious weeds distribution and cover to increase was evaluated based on the amount of land potentially disturbed or land use changes.

4.11.2 Effects Common to All Alternatives

All of the alternatives are likely to increase the distribution and cover by noxious weeds due to disturbance associated with construction, and for Alternatives 1 and 4 because of the removal of irrigation from agricultural lands. The removal of irrigation from up to 69,200 acres (No Action Alternative) and 17,137 acres of agricultural lands (Alternative 4) have the potential to substantially increase the distribution and cover of noxious weeds depending on how the lands will be managed and weeds controlled following the removal of irrigation.

Reservoir and pipeline facilities associated with Alternatives 2 and 3 would likely have similar potential to increase the cover by noxious weeds; however, the realignment of a portion of U.S. 287 associated with Alternative 2 would increase the potential for the spread of noxious weeds for Alternative 2.

Table 4-8. Summary of Permanent Impacts to Vegetation for All Alternatives.

	Alternative 1 (ac.)	Alternative 2 (ac.)	Alternative 3 (ac.)	Subalternative 4.1 (ac.)	Subalternative 4.2 (ac.)
Upland native grasslands	Minor	2,224–2,251	2,207	1,738–1,744	1,700
Upland mixed grasslands	Minor	241–243	2,765	202–203	2,726
Upland introduced grasslands	Minor	121–122	119–120	95–96	93–94
Mesic native grasslands	Minor	54	4	54	4
Mesic mixed grasslands	Minor	216	305	203–204	292
Upland native shrublands	Minor	481–489	<1	482–489	0–1
Mesic native shrublands	Minor	30	0	30	0
Mesic mixed shrublands	Minor	56	0	56	0
Upland native woodlands	Minor	1	0	1	0
Mesic mixed woodlands	Minor	21	6	21	6
Agricultural lands	Minor	220	722	187–189	689
Revegetated areas	Minor	45–46	0	45–46	0
Disturbed areas	Minor	76–80	106	76–80	106
Landscaped areas	Minor	0	0	0	0
Roads	Minor	87–88	0	87–88	0
Palustrine persistent emergent wetlands ¹	Minor	42–44	32	42–44	32
Palustrine scrub-shrub wetlands ¹	Minor	<1–1	<1	<1–1	<1
Other waters (ponds and lakes) ¹	Minor	1	5	1	5
Other waters (creeks and streams) ¹	Minor	2	1	2	1
Other waters (ditches and canals) ¹	Minor	4	2	4	2
Subtotal^{3,4}	Minor	3,922–3,969	6,274–6,275	3,326–3,351	5,656–5,658
Agricultural Transfer Lands⁵	Major				
Alfalfa				6,002	6,002
Corn				6,218	6,218
Dry beans				603	603
Fallow				454	454
Grass/pasture				1,153	1,153
Small grain				1,659	1,659
Sugar beets				465	465
Vegetables				199	199
Palustrine persistent emergent wetlands ²				352	352
Palustrine scrub-shrub wetlands ²				1	1
Other waters (ponds and lakes) ²				18	18
Other waters (creeks and streams) ²				<1	<1
Other waters (ditches and canals) ²				13	13
Total Wetlands ⁵	1,384 ⁶			384	384
Agricultural Transfer Lands Subtotal⁵	69,200⁶			17,137	17,137
Total⁶	Minor⁷	3,922–3,969	6,274–6, 275	20,463–20,488	22,793–22,795

¹These are estimates only, based on acreages calculated for Alternative 4. The affected area could range from 33,627 to 69,200 acres.

¹Includes agricultural lands, wetlands, and other waters in the reservoir, pipeline, and canal study areas that are not in the Agricultural Transfer Lands study area.

²Includes wetlands and other waters in the agricultural transfer areas (areas where water would be transferred from the Larimer and Weld and New Cache Canals).

³Subtotal without Agricultural Transfer Lands.

⁴Potential error due to rounding +/- 10 (ac).

⁵Potential error due to rounding +/- 2.5 (ac).

⁶Potential error due to rounding +/- 12.5 (ac).

⁷Impacts associated with the No Action alternative are estimated to be minor because most of the impacts to these resources, except for Agricultural Transfer Lands, would occur with aggregate mining prior to conversion of the aggregate mining facilities to water supply reservoirs.

The effects to the cover and distribution of noxious weeds associated with Alternatives 1 and 4 are likely to be major impacts due to the large area of land that would be disturbed by the removal of irrigation. The effects to the cover and distribution of noxious weeds associated with Alternatives 2 and 3 are likely to be minor to moderate because the reservoirs associated with these alternatives would inundate and eliminate existing areas of noxious weeds. The newly disturbed areas that may be invaded by noxious weeds are unlikely to result in a net increase in the cover and distribution of noxious weeds for the alternatives with implementation of appropriate BMPs.

4.11.3 Mitigation

Any permitted alternative will be required to develop and properly implement a noxious weed-control plan that follows all state and county requirements and guidelines (see Chapter 5).

4.12 WETLANDS AND OTHER WATERS

Effects to wetlands and other waters were raised as issues during scoping. This section summarizes the potential effects to wetlands and other waters associated with the alternatives. Figures 3-10 through 3-13 show the wetlands and other waters at the Glade Reservoir study area, the Galeton Reservoir study area, the Cactus Hill Reservoir study area, and the U.S. 287 realignment study area. Indirect effects to other waters from reservoir operations are described in Section 4.3.

4.12.1 Methods

Potential effects to wetlands or other waters include the direct and indirect effects of the construction and

operation of proposed project facilities such as reservoirs and associated structures, roads, pipelines, and canals.

Effects to wetlands and other waters include benefits (positive effects) resulting from the alternatives, as well as impacts that are negative. Effects to wetlands or other waters are described as “minor” or “major” based on the following criteria. “Minor” is used when effects would be at low levels, are unlikely to cause a permanent loss of wetland functions, and are unlikely to have a noticeable long-term effect on wetlands or other waters. Minor effects include temporary impacts during construction, and are typically short-term. “Major” is used when permanent impacts to large areas of wetlands or other waters would occur and wetland functions would be lost. Major effects are typically long-term. The term “no impact” is used when there are no changes to existing conditions from the alternatives.

Methods for evaluating effects to wetlands or other waters are described in greater detail in the Wetlands and Other Waters Technical Report (ERO 2008b).

Four methods used to evaluate wetlands in the study areas based on access to the sites were: 1) delineate wetlands and waters of the U.S. and conduct a functional assessment of wetlands and other waters; 2) conduct a reconnaissance-level survey of wetlands and other waters; 3) conduct an assessment of agricultural lands; and 4) conduct a wetland assessment along the Cache la Poudre and South Platte rivers.

4.12.1.1.1 Delineation and Functional Assessment of Wetlands and Other Waters of the U.S.

For the Glade Reservoir, U.S. 287 realignment, Galeton Reservoir, and Cactus Hill Reservoir study areas, wetlands were delineated and a functional assessment was conducted.

Wetlands and other waters were delineated using guidelines outlined in the 1987 Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987).

ERO surveyed most of the wetland and waters boundaries at the Glade Reservoir, Galeton Reservoir, Cactus Hill Reservoir, and U.S. 287 realignment study areas using a Global Positioning System (GPS) unit with submeter accuracy. ERO mapped portions of the reservoirs and U.S. 287 realignment study areas by drawing the wetland boundaries on aerial photographs.

Wetland Functional Assessment. ERO visited 13 representative wetlands in the Glade Reservoir, U.S. 287 realignment, Galeton Reservoir, and Cactus Hill Reservoir study areas to evaluate wetland functions. Functional assessments were performed on representative wetland types using the Montana Wetland Field Evaluation Form and Instructions (Montana Department of Transportation 1996). The Montana Method is described further in Section 3.12.1.1.3.

Wetlands were assessed using reconnaissance-level surveys in the Glade to Horsetooth, Cactus Hill to Horsetooth, and Carter pipeline study areas; the Poudre Valley Canal study area; and portions of the Cactus Hill and Glade reservoir study areas, Munroe Canal relocation, and U.S. 287 northern alternative alignment study area due to lack of access.

Wetland functions and values were assessed qualitatively for the study areas surveyed on a reconnaissance level. The wetlands were qualitatively rated as high, medium, low, or not applicable for each of the functions and values.

ERO used CDOW wetland and riparian mapping to determine the approximate area of wetlands in the Agricultural Transfer Lands study area and gravel pit locations for the No Action alternative (CDOW

2006). National Wetlands Inventory (NWI) maps from the U.S. Department of Interior were used to confirm which vegetation types in CDOW's mapping were wetland vegetation types. Aerial photography from 1989 to 1999 at a scale of 1:24,000 was used to confirm the approximate boundary of the wetlands and waters in the Agricultural Transfer Lands study area. Nonirrigated portions of the nearby Cobb Lake and Nunn quadrangles were used as a nonirrigated reference area to compare with the irrigated areas to estimate the relationship between irrigation and wetlands in the Agricultural Transfer Lands study area.

4.12.2 Effects Common to All Alternatives

4.12.2.1.1 Temporary Disturbance to Wetlands or Other Waters

All of the alternatives would result in temporary disturbances to wetlands or other waters from construction of facilities. Temporarily impacted wetlands would be regraded and revegetated to their approximate original condition following construction according to a wetland mitigation plan. Species composition in revegetated areas may differ from current conditions. This is a minor short-term effect on wetlands and other waters.

4.12.2.1.2 Change in Existing Reservoir Water Levels

The Reclamation No Contract subalternatives would not result in changes in water levels at Horsetooth Reservoir and Carter Lake. On the other hand, all of the Reclamation Contract subalternatives would generally result in minor changes in water surface levels at Horsetooth Reservoir and Carter Lake throughout the year and during the growing season (Section 4.10.2.2). The minor changes in water levels at Horsetooth Reservoir and Carter Lake

would have no long-term effect on adjacent wetlands.

4.12.3 Alternative 1—No Action

The No Action alternative would involve the conversion of gravel pits to reservoirs for water supply storage along the South Platte River near Fort Lupton, along Boulder Creek near Boulder, along St. Vrain Creek downstream of Longmont, along the Big Thompson River downstream of Loveland, and on the Cache la Poudre River downstream of Fort Collins. Mining these sites would adversely affect about 150 acres of wetlands and waters. These effects would occur prior to use of the facilities by the Participants. The conversion of these gravel pits to water supply reservoirs would not likely adversely affect wetlands; however, activities such as placement of inlet and outlet structures would likely have minor adverse impacts on wetlands and waters. The No Action alternative also may temporarily impact wetlands and other waters due to the construction of pipelines and improvements to ditches. Quantification of impacts associated with pipelines is not possible because the locations of these facilities are unknown at this time. Impacts to wetlands associated with the conversion of the gravel pits to water supply reservoirs is estimated to be minor because the majority of the impacts to wetlands would occur with aggregate mining.

Under the No Action alternative, irrigation would be removed and transferred to M&I uses. It was assumed that wetlands supported by irrigation comprise about 2 percent of the up to 69,200 acres of total irrigated lands that would be dried up or about 1,384 acres of irrigated wetlands.

The No Action alternative would not substantially affect streamflows in the region. It was assumed that the points of diversion involved in any transfer would not change, due to the inability to predict

where the changes would occur. The transfer of irrigation water to M&I use could result in changes in the points of diversion to locations near the mouth of the Poudre Canyon where many municipalities have their diversions. Changes in the points of diversion could reduce streamflows between the historical point of the diversion and any new point of diversion. The analysis assumed no changes in streamflows and that the No Action alternative is unlikely to affect wetlands along the Cache la Poudre and South Platte rivers.

4.12.4 Summary of Effects to Wetlands and Other Waters

Table 4-9 summarizes the direct effects to wetlands and other waters that would occur under all of the alternatives. The largest area of effects to wetlands associated with the action alternatives would occur under Alternative 4 because it involves the removal of irrigation water from large areas of wetlands in agricultural lands (353 acres), with most of the impacts to palustrine persistent emergent wetlands (352 acres). The total impacts to wetlands under the Alternative 4 subalternatives (including impacts at the reservoir sites, pipelines, and agricultural lands) ranges from 384 to 397 acres. Because of the large area of wetlands that would be permanently impacted under Alternative 4, the impacts are considered to be major long-term effects.

Permanent impacts to wetlands under Alternative 2 range from 42 to 45 acres, and consist primarily of impacts to palustrine persistent emergent wetlands at Glade Reservoir. Permanent impacts to wetlands under Alternative 2 are considered major long-term effects. The subalternative with the western realignment of U.S. 287 would have about 1.7 acres more permanent impacts to wetlands than the subalternative with the northern realignment. Alternative 3 would cause the loss of about 79 acres

Table 4-9. Summary of Effects to Wetlands and Other Waters for All Alternatives.

Wetlands and Other Waters	Alternative 1		Alternative 2			Alternative 3			Alternative 4		
	Perm. (ac.)	Temp. (ac.)	Perm. (ac.)		Temp. (ac.) ³	Perm. (ac.)		Temp. (ac.) ³	Perm. (ac.)		Temp. (ac.) ³
			Direct ¹	Indirect ²		Direct ¹	Indirect ²		Direct ¹	Indirect ²	
Palustrine persistent emergent wetlands			42–44	0	8–9	32	33	14–16	384–396 ⁵	33	8–16
Palustrine scrub-shrub wetlands			<1–1	0	1–2	<1	14	2–3	<1–1	14	1–3
Total Wetlands	1,384^{1,3}		42–45¹	0	9–10	32	47	16–19	384–397⁴	47	9–19
Total Other Waters			7		9–10	7		90–91	38⁴		9–91

¹Direct permanent effects include reservoir and dam footprints, forebay, pump stations, associated facilities, pipeline connections to the reservoir, and realigned roads. Ranges are used to summarize effects of subalternatives.

²These impacts are associated with the lining of the Poudre Valley Canal to convey water to Cactus Hill Reservoir.

³Temporary effects would include construction impacts for dam, reservoirs, pump stations, realigned roads, and other facilities; access roads; borrow areas; and pipelines.

⁴These acreages are estimates based on the calculations of the Agricultural Transfer Lands.

of wetlands, most of which are palustrine persistent emergent wetlands. These impacts would be a major long-term effect.

A function and value assessment was conducted for the wetlands in the reservoir sites and in the U.S. 287 realignment study area. Almost all of the wetlands that would be affected under the action alternatives are palustrine persistent emergent wetlands.

The Glade Reservoir and U.S. 287 study areas contain both riverine (occurring along a river or stream) and depressional (occurring in depressions) wetlands. The riverine wetlands in the Glade Reservoir and U.S. 287 realignment study areas generally rated moderate to high for general wildlife habitat, sediment/nutrient/toxicant removal, production export/food chain support, and sediment/shoreline stabilization. The depressional wetlands in the Glade Reservoir and U.S. 287 study areas generally rate moderate to high for general wildlife habitat, sediment/ nutrient/toxicant removal, production export/food chain support, and ground water discharge/recharge. The Galeton and Cactus

Hill reservoir study areas contain depressional wetlands. The depressional wetlands in the Galeton and Cactus Hill reservoir study areas generally rate moderate to high for general wildlife habitat, sediment/nutrient/toxicant removal, production export/food chain support, and ground water recharge/discharge.

Changes in streamflows are not anticipated to cause losses in wetland and riparian vegetation for the following reasons:

- The greatest changes in flow and stage will occur on the Poudre River during high flows. These higher flows and their associated stream stages occur infrequently (a few days over the 50-year hydrologic record) and are unlikely to support wetland vegetation, most of which typically occurs at lower elevations closer to the river.
- Many of the cross sections reviewed in November 2007 had wetlands that were saturated at the observed seasonally low flows (less than 30 cfs).
- Many of the cross sections were observed to have sources of hydrologic support in

addition to the Poudre River (e.g., irrigation ditches, return flows, ponds, and seeps).

- The changes in stream stage of the most frequently occurring flows, which have a greater potential to support wetlands than the less frequently occurring higher flows, will be minor, with changes ranging from 1 to 3 inches.
- Reductions in South Platte River flows associated with the action alternatives are estimated to be relatively minor and would not adversely affect the supportive hydrology for wetlands along the South Platte River. The largest changes in streamflows will occur in fall and winter outside of the growing season.
- The reductions in average flows would not cause a similar reduction in the wetted width of the channel and the proportional decrease in depth is much less than the proportional reduction in flow.

Permanent direct impacts to other waters include ponds and lakes, creeks and streams, and ditches and canals. Permanent impacts to waters are approximately 7 acres under Alternatives 2 and 3. Under Alternative 2, most of these impacts would occur to ditches and canals; under Alternative 3, most of these impacts would occur to ponds (mainly stock ponds); and under Alternative 4, impacts to waters would be approximately 38 acres. Most of the impacts to waters under Alternative 4 would occur to ponds and lakes within the Agricultural Transfer Lands study area. These stock and irrigation ponds would be dried up when irrigation water is removed.

Temporary impacts to wetlands and other waters would occur under the action alternatives, primarily from pipelines. Temporary impacts to wetlands and other waters would be reestablished by grading to the previous contours and revegetating (in the case of wetlands). These temporary impacts are considered minor and short-term.

4.12.4.1 Mitigation Recommendations

Direct impacts to existing wetlands and other jurisdictional waters of the U.S. would be avoided and minimized to the greatest extent possible during final design and construction of the project by using BMPs (see Chapter 5).

4.12.4.1.1 Restoration of Temporary Impacts

All temporary impacts to wetlands from pipeline crossings, construction disturbance, and other activities would be restored in place by:

- Salvaging and replacing wetland topsoils.
- Regrading wetland sites to preconstruction elevations and contours.
- Revegetating disturbed areas with appropriate native seeds and plantings.

All temporary impacts to creeks, ditches, and ponds would be restored by returning the sites to preconstruction contours.

4.12.4.1.2 Compensatory Mitigation

Direct permanent impacts to wetlands under each alternative would be compensated as described in Chapter 5 and summarized in Table 4-10.

4.13 RIPARIAN RESOURCES

This section focuses on the potential indirect effects of reduced flows on riparian resources. Pipelines, diversion structures, and outfalls would have temporary and minor permanent direct effects on riparian vegetation and are addressed in Section 4.10.

4.13.1 Methods

Effects to riparian resources from streamflow reductions were evaluated as part of the River Morphology and Sediment Transport Technical Report (Anderson 2008) and are discussed in the

Table 4-10. Summary of Compensatory Wetland Mitigation Areas.

Alternative	Location	Acreage of Wetlands Lost	Acreage Estimated ¹
Alternative 1	Combination of mitigative actions	1,384	Not calculated
Alternative 2	Below the Glade Reservoir dam	42–45	56
Alternative 3	Below Black Hollow Reservoir and a combination of mitigative actions	79 ²	79
Alternative 4	Either the Glade or Black Hollow Reservoir site, depending on subalternative, and a combination of mitigation actions	384–397	384–397
U.S. 287 realignment only	Between Wetlands 14 and 15 in the U.S. 287 realignment study area	1–3	3

¹The acreage of estimated compensatory mitigation is higher than the acreage required because the plans are preliminary and conceptual. When the plans are finalized, the size of the proposed wetland mitigation sites would be adjusted to replace the wetlands lost on an acre-for-acre basis with wetlands similar in types and functions provided for the wetlands lost.

²Includes impacts associated with lining the Poudre Valley Canal to convey water to Cactus Hill Reservoir.

Vegetation Resources Technical Report (ERO 2008a). Representative channel cross sections were reviewed for the distribution of riparian and wetland vegetation and flows and stream stage were evaluated for the cross sections.

4.13.2 Alternative 1—No Action

The No Action alternative would involve the conversion of gravel pits to water supply reservoirs, the transfer of agricultural lands to M&I use, and increased use of alluvial ground water for some Participants. The transfer of agricultural water to M&I use is not expected to change streamflows and would not affect riparian resources. The conversion of gravel pits to water supply reservoirs may have minor localized temporary or permanent impacts on riparian vegetation from construction of facilities associated with the water supply reservoirs (e.g., water intakes and outfalls). Reservoir outfalls could also benefit riparian vegetation depending on their locations. Alluvial wells could permanently impact riparian vegetation if ground water levels associated

with the wells are drawn down below elevations that support riparian vegetation.

4.13.3 Effects Common to All Action Alternatives

All of the action alternatives would cause reduced flows on the Cache la Poudre and South Platte rivers. The effects of these flow reductions were previously presented in Section 4.2.1.4.

4.13.4 Mitigation

The indirect effects to riparian vegetation will be mitigated by:

- Working with land managers along the Poudre River from the canyon mouth to I-25 to identify areas suitable to plant native woody riparian vegetation and disturb decadent stands of woody riparian vegetation to help compensate for the reduction in disturbance from reduced overbank flows.
- The District is proposing to develop and implement a stream habitat enhancement

plan for an approximate 0.5-mile reach of the Poudre River in the vicinity of the Watson Fish Hatchery. The plan will mitigate for impacts to aquatic life and riparian habitat associated with the action alternatives, will be coordinated with, and approved by, CDOW, and will address increasing the channel depth, adding structure and diversity to the stream habitat, and establishing woody riparian vegetation.

- The District will implement a monitoring and adaptive management program as part of the mitigation for effects to stream morphology (Section 4.4.3). This program would be used, in part, to monitor effects to riparian vegetation and would include riparian vegetation monitoring and measures that could be used to benefit riparian vegetation.

4.14 WILDLIFE

This section summarizes the potential effects to wildlife associated with the alternatives. Potential effects to wildlife include the direct effects to wildlife and wildlife habitat associated with proposed project facilities, such as reservoirs and associated structures, roads, pipelines, and canals. Indirect impacts, both temporary and permanent, such as those that might occur due to noise or visual disturbance, are also described.

4.14.1 Methods

Effects to wildlife include benefits, or positive effects, resulting from the alternatives, as well as impacts, which are negative. Effects to wildlife are described as “minor,” “moderate,” or “major” based on the following criteria. “Minor” is used when the benefits or impacts would be at low levels and may not have a noticeable effect on wildlife. Minor effects include temporary impacts during construction. Minor effects typically are short-term.

“Moderate” is used when impacts to wildlife would affect individuals or small groups of wildlife, but would not affect populations or large areas of wildlife habitat. “Major” is used when impacts to large populations or large areas of wildlife habitat would occur. Major effects typically are long-term. The term “no impact” is used when there are no changes to existing conditions from the alternatives. Methods for evaluating effects to wildlife are described in the Wildlife Technical Report (ERO 2008c). The effects to wildlife are summarized for big game species and migratory birds; raptors, amphibians, and reptiles; and other wildlife in Table 4-20 at the end of Chapter 4.

4.14.2 Effects Common to the Action Alternatives

4.14.2.1 SPWCP Forebay and Diversion

The SPWCP is common to all action alternatives and would include a diversion structure on the South Platte River, a forebay, pump station, and pipelines to deliver water diverted from the South Platte River to Galeton Reservoir and ditch systems for exchange. Construction of the SPWCP forebay and diversion would result in permanent impacts to about 21 acres of mule deer severe winter range, primarily in Game Management Unit (GMU) 951, representing less than 1 percent of the mule deer severe winter range in GMU 951. About 21 acres of agricultural land potentially supporting waterfowl, songbirds, raptors, reptiles, amphibians, and other wildlife would be lost in the SPWCP forebay and diversion construction footprints. Less than 1 acre of riparian habitat would be permanently affected by construction of the SPWCP forebay and diversion (ERO 2008c). These impacts are considered minor effects to wildlife.

4.14.3 Temporary Disturbances

All of the action alternatives would result in temporary disturbances to wildlife and their habitat from construction of the dam, spillway, roads, pipeline, and other facilities. Temporarily impacted areas would be revegetated following construction according to a revegetation plan. Revegetated areas are likely to take several years to recover, and plant and wildlife species composition may differ from current conditions, particularly where forested or upland shrub vegetation is removed.

4.14.3.1 Pipelines

Pipelines associated with the action alternatives include the SPWCP pipelines and either the Glade to Horsetooth pipeline (Alternative 2 and Subalternative 4.1 under the Reclamation Contract Subalternative), the Cactus Hill to Horsetooth pipeline (Alternative 3 and Subalternative 4.2 under the Reclamation Contract Subalternative), or the Carter pipeline (under the Reclamation No Contract Subalternative). These impacts are discussed in the Wildlife Technical Report (ERO 2008c). The pipeline routes follow existing roads where possible, and primarily traverse agricultural areas and grasslands. The pipeline routes cross riparian areas, wetlands, and waters providing habitat for a variety of wildlife species. Most impacts to wildlife habitat associated with the pipelines would be temporary; however, pump stations and other structures necessary to distribute water would result in minor permanent impacts. These impacts are considered minor short-term effects to wildlife.

4.14.3.2 Change in Existing Reservoir Water Levels

In general, all of the Reclamation Contract Subalternatives would result in changes in water surface levels at Horsetooth Reservoir and Carter

Lake (Section 4.10.2.1). Potential effects on wildlife at Horsetooth Reservoir and Carter Lake were assessed based on projected changes in riparian vegetation, as described in the Vegetation Resources Technical Report (ERO 2008a) and Wetlands and other Waters of the U.S. Technical Report (ERO 2008b). Changes in water surface elevations of Horsetooth Reservoir and Carter Lake would not likely affect shoreline vegetation. Thus, there would be no effect on wildlife species associated with wetland, riparian, or upland habitats due to minor water level fluctuations for all action alternatives.

4.14.3.2.1 Riparian and Wetland Habitat Downstream of New Reservoirs

Riparian or wetland vegetation downstream of the proposed Glade, Cactus Hill, and Galeton reservoirs may develop. Drainages downstream of the Glade, Cactus Hill, and Galeton reservoir sites are on ephemeral channels. Seepage below a dam could result in the development of riparian or wetland vegetation, which could have a minor positive effect on wildlife.

4.14.3.2.2 Riparian Habitat along the Cache la Poudre and South Platte Rivers

All action alternatives would result in reduced flows in the Cache la Poudre River downstream of the Poudre Valley Canal diversion, especially during high-flow periods (HDR 2007b). As described in the Wildlife Technical Report (ERO 2008c), the flow reductions are not expected to cause losses of riparian and wetland habitat. However, a reduction in the infrequently occurring overbank flows may affect the periodic disturbance of the riparian zone that can aid in creating new habitat for riparian vegetation establishment and rejuvenation of the riparian zone.

4.14.3.3 U.S. 287 Realignment Study Area

Direct impacts to wildlife habitat that would result from the U.S. 287 realignment alternatives are

summarized in Table 4-20 at the end of Chapter 4. CDOW and CDOT will coordinate on which realignment alternative has the least effects on wildlife.

4.14.3.3.1 Direct and Indirect Impacts

Big Game Species. Neither the western nor northern U.S. 287 realignment alternative would affect severe winter range or concentration areas for any big game species, although some overall and winter mule deer habitat would be affected. Because current east-west movements of deer and elk may shift north and/or south as a result of the construction of Glade Reservoir, both alternative realignments could result in an increased risk of big game/vehicle collisions, especially in the northernmost and southernmost areas. Also, both alternative realignments could disrupt north-south movements of deer and elk where they cross the hogbacks.

Migratory Birds and Raptors. Direct effects to the habitats of migratory birds would be similar for either the western or northern realignment alternative. The western and northern alignments travel through the Holcim Mine, which is composed mainly of disturbed and reclaimed areas of limited value to wildlife. Between 37 and 58 percent of the surface impacts from the U.S. 287 realignment would occur in either disturbed or reclaimed areas. However, some impacts to vegetation communities providing high quality bird habitat (primarily native or mixed grasslands and shrublands, and associated bird species) would occur as a result of the road realignment. About 54 acres of grasslands and about 23 acres of shrublands would be permanently lost as a result of the western realignment. The northern realignment would have greater impacts on these habitat types and their associated bird species, and would result in permanent impacts to about 61 acres of grasslands and about 31 acres of shrublands.

For both realignment alternatives, only small amounts of riparian, wetland, and aquatic habitat would be impacted. The western alignment would result in the loss of 4 acres of wetland and riparian habitat, and the northern alignment would result in the loss of 2 acres of wetland and riparian habitat. Temporary impacts to wetland, riparian, and aquatic habitat would occur to less than 1 acre for the western realignment and less than 3 acres for the northern realignment. Permanent impacts from either alternative would occur to 1 acre of aquatic habitat potentially supporting waterfowl and shorebirds.

Individual home ranges for birds may be fragmented by either realignment. Construction of the roadway would result in temporary and permanent habitat loss and stress to individuals from increased noise and human presence.

Reptiles and Amphibians. Reptiles and amphibians in the affected vegetation types described in the Vegetation Resources Technical Report (ERO 2008a) would be directly affected by the U.S. 287 realignment through the loss of habitat and mortality that could occur during highway construction. Direct effects to reptiles and amphibians would be similar for either realignment alternative. Both the western and northern alignment travel through the Holcim Mine, which is composed primarily of disturbed and reclaimed areas of limited value to wildlife.

For both realignment alternatives, only small amounts of riparian, wetland, and aquatic habitat would be impacted. Permanent impacts from either alternative would occur to less than 1 acre of aquatic habitat potentially supporting reptiles and amphibians. Also, individual home ranges and dispersal corridors for reptiles and amphibians may be fragmented by either of the realignments.

Other Wildlife Species. Direct effects to small and large mammals would be similar for the western and northern realignment alternatives. Highways create potential barriers to wildlife movement. Although the proposed realignments would not directly impact general wildlife species more than the current alignment, individual home ranges for mammals may be fragmented by the new roadway. Construction of the roadway would result in temporary and permanent habitat loss and stress to individuals from increased noise and human presence.

Direct effects to wildlife habitat would be similar to those described for birds. Although a large portion of surface impacts from the U.S. 287 realignment would occur in either disturbed or reclaimed areas, some impacts to upland native grasslands and shrublands and associated wildlife species would be likely. The northern realignment would have slightly greater impacts on these habitat types and associated wildlife species than the western realignment.

4.14.4 Alternative 1—No Action

The No Action alternative involves the use of gravel pits from which aggregate has been extracted. These sites would be converted to water supply storage for the No Action alternative. Temporary impacts would occur to wetland and riparian habitat from constructing pipelines and ditches, and improving canals as part of the No Action alternative. The impacts from the acquisition of and improvements to gravel pits and temporary impacts along pipelines, canals, and ditches are considered minor short-term effects to wildlife.

In addition, up to 69,200 acres of irrigated agricultural land would be dried up as a result of the No Action alternative (HDR 2007b). Methods for estimating losses of irrigated wetlands and croplands

resulting from the dry up of agricultural lands are described in detail in the Wetlands and Other Waters of the U.S. Technical Report (ERO 2008b) and the Vegetation Resources Technical Report (ERO 2008a). An estimated 1,384 acres of irrigated wetlands would dry up as a result of the No Action alternative. The agricultural wetlands that would be dried up generally provide low- to moderate quality wildlife habitat because they are supported by flood irrigation and are often subjected to tilling and other disturbances. The No Action alternative also would result in a large-scale dry up of irrigation ditches and ponds. Losses of irrigated cropland and wetlands, as well as open water habitat, would affect wildlife, although most of the species associated with these habitats are generalist, disturbance-tolerant species. Wildlife most likely to be affected by the loss of cropland and other agricultural land include species that may use these areas for foraging or cover such as raccoon, ring-necked pheasant, and Canada goose. Wildlife potentially affected by the loss of irrigated wetlands include Woodhouse's toad and a variety of waterfowl species. Although irrigation canals and ditches are periodically cleared or dredged, the loss of open water habitat could impact species such as snapping turtles, water snakes, and mallards. Many of the agricultural lands dried up as a result of the No Action alternative would likely be converted to upland grasslands, potentially providing future habitat for grassland-associated wildlife. The impact to wildlife associated with the transfer of agricultural lands could be a minor long-term benefit to wildlife.

The loss of riparian habitat during excavation of gravel pits would primarily affect white-tailed deer and mule deer that use these areas for foraging, thermal and hiding cover, and as travel corridors. However, habitat losses would likely have a minor effect on these species given the small proportion of affected habitat relative to the surrounding areas.

It was assumed that the No Action alternative would not affect streamflows in the Cache la Poudre River; therefore, there would be no effect to wildlife along the Cache la Poudre River.

4.14.4.1 Summary of Effects for Alternatives 2 through 4

Table 4-20 at the end of Chapter 4 summarizes the impacts that could occur to wildlife under Alternatives 2 through 4.

Alternatives 2 and 3 would involve permanent impacts to about 166 acres of pronghorn severe winter range. The permanent impacts to pronghorn severe winter range are considered minor long-term effects. In addition, temporary impacts to 125 acres of pronghorn severe winter range and 12 acres of mule deer severe winter range would occur. These temporary impacts would not have an impact on pronghorn or mule deer populations. For Alternative 4, the impacts would be similar, except less pronghorn winter concentration area would be affected.

Impacts to big game overall habitat would be similar for Alternatives 2 and 3, except that Alternative 3 would result in the loss of slightly more white-tailed deer habitat and would not impact elk habitat (Table 4-20). More mule deer winter concentration area and white-tailed deer concentration area would be lost as a result of Alternative 2 than Alternative 3. Overall ranges for all of the species discussed above, and mule deer and white-tailed deer concentration areas, are relatively widespread in the affected GMUs, although more fragmented where development has occurred.

Under Alternative 2, there would be a loss of 42 to 45 acres of wetland habitat, 7 acres of aquatic habitat, 481 to 489 acres of shrubland, and 2,877 to 2,885 acres of grassland habitat, which would impact associated species. Alternative 3 would

result in greater permanent impacts to wetlands and riparian and aquatic habitat (Table 4-20). This habitat loss is considered a moderate long-term effect to wildlife. Mortality and nest destruction could occur during construction. Temporary impacts include disturbance of vegetation and increased noise and human presence. These temporary impacts would have a minor effect on wildlife populations.

4.14.5 Mitigation

The District and Corps will coordinate with CDOW regarding mitigation of impacts to wildlife and wildlife habitat. Mitigation measures for migratory birds and raptors are addressed in Section 5.4.

4.15 FISH AND OTHER AQUATIC LIFE

This section summarizes the potential effects to aquatic biological resources associated with the project alternatives. Potential effects include the direct and indirect effects of proposed project facilities such as reservoirs and associated structures and their operation, roads, pipelines, and canals. The effects to aquatic biological resources would be due primarily to changes in hydrology associated with the action alternatives.

4.15.1 Methods

Methods for evaluating effects to aquatic biological resources are described in the Aquatic Biological Resources Technical Report (GEI 2008). The evaluations focus on the aspects of aquatic resources that are relevant for assessing potential effects for fish and benthic invertebrate communities. Streamflow and simulated habitat availability for the action alternatives were compared to simulated

baseline hydrology and habitat availability. Assuming no change in points of diversion, hydrology and habitat availability for the No Action alternative would be similar to existing conditions.

This analysis evaluated the potential for direct and indirect effects on fish and invertebrate communities in the streams in the study areas. Fish and invertebrate communities are collectively referred to as aquatic biological resources. The relevant parameters for evaluation were the number and abundance of fish and invertebrate species. The analysis was focused on the suitability of the habitat to support a higher or lower number of species and abundance of fish and invertebrates for each alternative.

Effects could be negligible, beneficial, or adverse. A negligible effect indicates that fish and invertebrate populations would continue to fluctuate within the normal historical range and any changes, either beneficial or adverse, would be too small to be detected by someone familiar with the resource or by collecting sampling data. Beneficial and adverse effects could vary in intensity from minor to moderate and major. A minor effect, either beneficial or adverse, would be detectable only through repeated sampling of fish or invertebrates. A minor effect would be the gain or loss of a few species of fish or invertebrates and a slight long-term change in abundance. A moderate effect would be easily recognized by someone familiar with the resources in a stream. This would include obvious changes in species composition and abundance that would be detectable by sampling data or by someone familiar with the resource. A major effect would be easily apparent. A major beneficial effect would represent substantial improvements to the diversity and abundance of fish or invertebrate communities. A major adverse effect would substantially compromise the functions of the aquatic community

with significant reductions in diversity and abundance.

This evaluation used two methods for assessing the potential effects of the alternatives. The first method was a comparison of hydrologic parameters and the second method was the Physical Habitat Simulation (PHABSIM) portion of the Instream Flow Incremental Methodology (IFIM). The comparison of hydrologic parameters summarizes changes in flow that are relevant to fish and invertebrates. The PHABSIM method (Bovee 1982) simulates a relationship between habitat availability and streamflows. These methods were used, along with professional judgment, to evaluate the relative effects of the alternatives on the number and abundance of fish and invertebrate species.

4.15.1.1 Hydrology

The comparison of hydrologic parameters between alternatives was the primary tool for evaluating the potential effects on aquatic resources. Summaries of mean monthly flow at nine locations on the Poudre River and one location on the South Platte River were evaluated (Appendix A). Hydrology was provided for wet, average, and dry years by HDR (2007b).

Aquatic biota including fish and invertebrates are generally influenced by extremes in flow and habitat conditions, which can act as a bottleneck to regulate population size. Average or more favorable conditions have less effect on population size and community structure. This evaluation of effects focused on relevant hydrologic parameters that most likely influence fish and benthic invertebrate populations in the streams in the study area. The two key parameters were the maximum and minimum flows during the year, based on mean-monthly hydrology. In the study area, high flows usually occur in late spring or early summer during

snowmelt runoff. Low flows usually occur in late summer during the irrigation season or in winter. During high flows, high water velocity makes habitat less suitable for fish and invertebrates because they have to expend more energy to hold their position and risk being dislodged downstream and out of preferred habitat locations. This is especially true for invertebrates and the younger life stages of fish. Although high flows have long-term benefits to channel maintenance functions, habitat availability for fish and invertebrates is generally lower at peak flows in the streams in this study area. During low flows, shallow depths and water receding from portions of the channel may result in less habitat and lower quality habitat for fish and invertebrates. It was assumed that further decreasing low flows or further increasing high flows could have adverse effects on aquatic resources. Increasing low flows or decreasing high flows could have beneficial effects on aquatic resources. However, the specific effects were evaluated more fully on a case-by-case basis in each segment.

A difference in maximum or minimum flows of 10 percent or greater was used to indicate that aquatic biological resources may be potentially affected and warranted further analysis. Differences of less than 10 percent are likely within the margin of error of the hydrologic and statistical data and would be unlikely to result in adverse or beneficial effects on aquatic biota.

Differences in key parameters of 10 percent or greater were further evaluated and may or may not result in effects on aquatic biota, depending upon the specific circumstances in each stream segment and each hydrologic scenario as discussed in the evaluation. Although the analysis focused on the two parameters noted above, the complete set of hydrology for wet, average, and dry years also was reviewed to ensure that special circumstances would

not occur that would lead to effects during other times of the year.

Fish and benthic invertebrate communities naturally fluctuate from year to year from the influences of factors such as weather and flow conditions (Hall and Knight 1981; Leland et al. 1986; Platts and Nelson 1988; Pearsons et al. 1992; Cattaneo et al. 2002; Chadwick et al. 2004). Fluctuations in populations of fish and invertebrates in the study area can be substantial under existing conditions. For example, several studies of invertebrates on the Poudre River indicated variability of several hundred percent for abundance and number of species between sites and years. However, the fish and invertebrates in the study area of the Poudre and South Platte rivers have not been sampled at a frequency or extent to allow a good characterization of the year-to-year variability. Therefore, it is unlikely that a 10 percent change in hydrology in any single year type (e.g., only wet years) would result in a noticeable long-term change in fish or invertebrate communities, given the natural background variability.

Analysis of hydrology may suggest some effects that are contradicted by output from PHABSIM. These factors were taken into account when evaluating the effects of the alternatives on fish and invertebrates communities in the study area.

4.15.2 Effects Common to All Action Alternatives

4.15.2.1 Cache la Poudre River

4.15.2.1.1 Upstream of Fort Collins

This segment of the study area has hydrologic modeling nodes at the canyon gage (CANGAGE), the Main 3 node downstream of the Greeley diversion (MAIN3), and the Main 6 node near Laporte (MAIN6). Habitat for brown and rainbow

trout was simulated with PHABSIM with the hydrology for MAIN3 near the middle of this segment. Water quality and riparian vegetation are not expected to change from existing conditions for any of the action alternatives in this segment of the river (ERO and HDR 2008; ERO 2008a) and would have no effect on aquatic biological resources. There would be minor increases in channel stability and minor constriction of the channel. There should be no increase in sedimentation (Anderson 2008).

Reductions in maximum flows during runoff in May, June, and July under the action alternatives would tend to increase habitat availability for brown and rainbow trout more than reductions in winter flows would decrease habitat availability. The reductions in peak flows also would tend to reduce movement and scouring of the substrate, which would tend to benefit benthic invertebrates that live in the substrate and also tend to benefit longnose dace, a common minnow species in the substrate in this segment. The benthic species of invertebrates and fish would probably tolerate the reduced winter flows and benefit from the reduced runoff flows. Therefore, the information on hydrology and habitat availability for fish and invertebrates indicates that the action alternatives would result in a minor beneficial effect to fish and invertebrate communities in this segment of the Poudre River (Table 4-11). There would be increases in abundance of fish and invertebrates and possibly increased number of species of invertebrates.

4.15.2.1.2 Near Fort Collins

The Poudre River segment from Shields Street downstream to College Avenue is in the transitional zone between coldwater and warmwater habitat. This segment of the study area of the Poudre River has no hydrologic modeling nodes. However, the node at the Lincoln gage (LINCAGE) is just downstream of the end of this segment and represents the flow through this segment.

PHABSIM habitat was simulated for brown trout and white sucker, two of the most common species in this segment. Water quality, riparian vegetation, and channel morphology are expected to be affected by the alternatives (ERO and HDR 2008; ERO 2008h). The changes in flow may result in narrowing of the channel, encroachment of riparian vegetation, slightly degraded water quality, and increased sedimentation of the substrate in this segment.

The information concerning channel morphology, hydrology, and PHABSIM habitat simulation suggests contradictory effects to the fish and invertebrate communities. The reduced peak flows with the action alternatives would lead to lower velocity during runoff and less scouring of the substrate, which would tend to be beneficial. The reduced flows also would allow the channel to narrow and riparian vegetation would encroach. These changes could be beneficial because the channel is currently too wide to provide suitable habitat for fish at low flows. Also, the encroaching vegetation may provide more cover for fish near the banks, which could result in higher quality habitat for fish. However, the narrowed channel would likely reduce the quality of bank habitat as stable banks offering cover with existing conditions would be replaced by low banks with low depositional areas adjacent to the active channel with less stability and cover for fish. This type of bank configuration usually does not provide high quality habitat for fish. The increased sedimentation and minor degradation of water quality would be detrimental to both fish and invertebrates. Reduced winter flows may also make the occurrence of extremely low flows more common.

PHABSIM habitat simulations suggest little differences in habitat availability for brown trout and white sucker. However, the use of PHABSIM assumes that channel morphology would not change.

Table 4-11. Summary of Effects to Fish and Other Aquatic Life for All Action Alternatives.

Stream Segment/Reservoir	Biological Parameter	Effects Common to All Alternatives
Cache la Poudre River		
Upstream of Fort Collins	Fish	Reduced runoff flows result in a minor beneficial effect
	Invertebrates	Reduced runoff flows result in a minor beneficial effect
Near Fort Collins	Fish	Reduced winter flows result in a minor adverse effect
	Invertebrates	Reduced winter flows result in a minor adverse effect
Fort Collins to I-25	Fish	Reduced runoff and increased winter flows result in a minor to moderate beneficial effect
	Invertebrates	Reduced runoff and increased winter flows result in a minor to moderate beneficial effect
I-25 to South Platte River	Fish	Channel narrowing, increased sedimentation, and slightly degraded water quality result in minor adverse effect
	Invertebrates	Channel narrowing, increased sedimentation, and slightly degraded water quality result in minor adverse effect
South Platte River		
Downstream of Poudre River	Fish	Differences among alternatives as explained in Section 4.15.2.2
	Invertebrates	Reduced runoff flows result in a minor beneficial effect
Reservoirs		
Glade/Cactus Hill Reservoir	Fish	Construction of proposed Glade Reservoir results in a major beneficial effect for fishery and sport fishery
	Invertebrates	Construction of proposed reservoir results in a major beneficial effect
Galeton Reservoir	Fish	Construction of proposed reservoir results in a major beneficial effect for fishery, but not sport fishery
	Invertebrates	Construction of proposed reservoir results in a major beneficial effect

The changes to the channel render the habitat simulations less representative of future habitat conditions. The net effect of these contradictory factors would be a minor adverse effect to fish and invertebrates of the action alternatives compared to existing conditions (Table 4-11). Changes to channel morphology, increased sedimentation, degraded water quality, and the greater occurrence of low flows would be detrimental to both fish and invertebrates. The adverse effects would result in lower abundance and fewer species of fish and invertebrates. These minor adverse effects would occur gradually over time, and fish and invertebrate communities would adapt to the new flow regime and channel morphology.

4.15.2.1.3 Fort Collins to I-25

The Poudre River from College Avenue downstream to I-25 contains transitional habitat between coldwater and warmwater reaches. This segment of the river contains two hydrologic modeling nodes that were used to represent the flow: the Main 12 node downstream of the Timnath Reservoir Inlet (MAIN12) and the Main 14 node downstream of the Fossil Creek Reservoir Inlet (MAIN14). Habitat for white sucker was simulated with PHABSIM using hydrology for the Main 12 node near the middle of this segment.

Water quality would be slightly degraded between existing conditions and the action alternatives (ERO and HDR 2008). Both riparian vegetation and channel morphology may be affected by the action alternatives, resulting in channel narrowing, encroachment of riparian vegetation, and increased sedimentation (ERO 2008a, 2008h).

The information from both hydrology and PHABSIM simulation indicates that the action alternatives would provide substantially more habitat for fish and invertebrates than baseline flow conditions. The action alternatives would have a

minor to moderate beneficial effect to the fish and invertebrate communities in this segment of the river (Table 4-11). This would result in increased abundance and number of species of fish and invertebrates. However, the beneficial effect would be lessened by the adverse effects of slightly degraded water quality, channel narrowing, and sedimentation.

4.15.2.1.4 I-25 to the South Platte River

The Poudre River from I-25 downstream to the confluence with the South Platte River contains warmwater habitat. Three hydrologic modeling nodes are in this segment of the river. The Main 18 node is downstream of Windsor (MAIN18), the Main 20 node is near Greeley (MAIN20) and is downstream of most of the diversions in the lower part of the river, and the Greeley gage (GRLYGAGE) node is downstream of Greeley. No PHABSIM habitat simulations were available for this segment of the river.

Water quality would be slightly degraded from existing conditions under any of the action alternatives (ERO and HDR 2008). Riparian vegetation and channel morphology may be affected, leading to a narrowed channel with vegetative encroachment and increased sedimentation. These adverse effects may be more severe in this segment of the river than in the segments upstream (Anderson 2008; ERO 2008a).

PHABSIM information is not available in this segment and the evaluation of effects is based on hydrologic information. The reductions in runoff flows in wet and average years would reduce velocity during peak runoff and would likely result in greater habitat availability for fish and invertebrates. However, the adverse effects of channel narrowing, increased sedimentation, and slightly degraded water quality would limit the benefits of reduced flows. The net result of the

changes in hydrology under the action alternatives would be a minor adverse effect to fish and invertebrates compared to existing conditions in this segment of the Poudre River (Table 4-11). This would result in less abundance and fewer species of fish and invertebrates in this section of the river.

4.15.2.2 South Platte River

4.15.2.2.1 South Platte River to Kersey Gage

The study area on the South Platte River extends from the confluence with the Poudre River downstream to the Kersey gage. The South Platte River in the study area is a warmwater river and is much larger than the Poudre River. One hydrologic modeling node at the Kersey gage (KRSYGAGE) represents this segment of the river. PHABSIM habitat was simulated for plains killifish, red shiner, sand shiner, and white sucker. Sand shiner and white sucker are two of the more common fish species in this segment. Red shiner is less abundant, but was collected during most sampling episodes. Plains killifish is less abundant, but uses shallow, low velocity habitat different from the shiners and sucker and helps evaluate a different habitat aspect of the river.

Water quality, riparian vegetation, and channel morphology are not expected to change from existing conditions under the action alternatives (ERO and HDR 2008; ERO 2008a, 2008h). The reductions in maximum flows with the action alternatives would tend to be favorable for fish and invertebrates in the South Platte River. However, the wide channel would limit the benefits of lowered flows. PHABSIM habitat simulations indicate that some species, such as plains killifish, would benefit with the differences in flow compared to existing conditions. However, plains killifish is relatively uncommon in this section of the river. Other species, such as red shiner and the more common sand shiner, have similar habitat availability with

existing conditions and all action alternatives. These species would not be affected by differences in flow. The slight differences in hydrology among the action alternatives would result in different habitat availability and effects on white sucker, one of the most common native species in this section of the South Platte River.

For invertebrates, reduced maximum flows would probably have a greater influence on the community than the relatively small reductions in minimum flows. The net effect to the invertebrate community in this segment of the South Platte River would be a minor beneficial effect for all action alternatives (Table 4-11), with greater abundance and number of species, as compared to existing conditions.

4.15.2.3 Glade/Cactus Hill Reservoir

All action alternatives would include the construction of a water storage reservoir. Alternative 2 and Subalternative 4.1 would include the construction of the proposed Glade Reservoir. Alternative 3 and Subalternative 4.2 would include the proposed Cactus Hill Reservoir. These reservoirs would be suitable to support a variety of fish and invertebrates and would result in a major beneficial effect under the action alternatives (Table 4-11) if Glade Reservoir is managed for recreational fishing. Establishing a fishery at these reservoirs would benefit wildlife that prey on fish.

4.15.2.4 Galeton Reservoir

All action alternatives would include the construction of the proposed Galeton Reservoir. This reservoir is not expected to be managed for recreational fishing; however, it would probably develop a community of fish and invertebrates, including fish species that enter from the South Platte River. The construction of Galeton Reservoir would result in a major beneficial effect allowing fish and invertebrates to exist where there is no

aquatic habitat under existing conditions (Table 4-11).

4.15.3 Alternative 1—No Action

Under the No Action alternative, existing gravel pits along the Cache la Poudre River, the South Platte River, the Big Thompson River, and Boulder Creek would be converted to reservoirs. The No Action alternative would involve almost no changes to streamflows in the study area because this alternative relies on the transfer of agricultural water and assumes no change in point of diversion. The No Action alternative would have a negligible effect on aquatic biological resources along the Cache la Poudre and South Platte rivers compared to existing conditions.

4.15.4 Alternative 2—Proposed Action—Glade Reservoir and the SPWCP

The Proposed Action would have the same effects common to all action alternatives as described above (Table 4-11). In addition, Alternative 2 would result in less habitat availability for the adult/juvenile life stage of white sucker in average and dry years in the South Platte River. This would result in a minor adverse effect to the fish community for Alternative 2 compared to existing conditions.

4.15.5 Alternative 3—Cactus Hill Reservoir and the SPWCP

Alternative 3 would have the same effects common to all action alternatives as described above (Table 4-11). In addition, Alternative 3 would result in less habitat availability for the adult/juvenile life stage of white sucker in average and dry years in the South Platte River. This would result in a minor adverse

effect to the fish community for Alternative 3 compared to existing conditions.

4.15.6 Alternative 4—Glade or Cactus Hill Reservoir and SPWCP and Agricultural Transfers

The two subalternatives for Alternative 4 would have the same effects common to all action alternatives as described above (Table 4-11). In addition, Alternative 4 would result in habitat availability similar to existing conditions for the adult/juvenile life stage of white sucker in average and dry years. This would result in a negligible effect to the fish community for Alternative 4 compared to existing conditions.

4.15.7 Mitigation

The District and Corps will coordinate with CDOW on the mitigation of impacts to aquatic resources as discussed in Section 5.1. The adverse effects that would occur in the Poudre and South Platte rivers as a consequence of NISP may be mitigated by several projects. One potential mitigation project would increase winter flows by approximately 10 cfs or more in the coldwater portion of the Poudre River upstream of the Poudre Valley Canal. A second mitigation project would physically improve the habitat in sections of the Poudre River to support a higher abundance of fish. A third mitigation project would reintroduce rare fish species into the Poudre River drainage. These projects are discussed in greater detail in Chapter 5.

4.16 SPECIES OF CONCERN

This section summarizes the potential effects of the alternatives on species of concern. Potential effects

to species of concern include the direct and indirect effects of proposed project facilities such as reservoirs and associated structures, roads, pipelines, and canals. Short-term direct impacts might occur during project construction and long-term direct impacts might occur during project operations. Indirect impacts, both temporary and permanent, such as those that might occur due to noise or visual disturbance, are also described.

4.16.1 Methods

For federally listed species, only those with potential habitat in the study areas are included in the impacts analysis. A Biological Assessment was prepared to address impacts to federally listed species and to consult with the Service under Section 7(a) of the ESA (Appendix B). The impacts analysis for state species of concern includes only those observed from 2000 to present at the study areas. Three species ranked by the CNHP as either S1 or S2 species have been observed at City of Fort Collins Natural Areas along the Poudre River: the smokey-eyed brown butterfly, two-spotted skipper, and the American currant. These species have not been recently recorded at any of the other study areas and are only included in the discussion of potential impacts to habitat associated with changes in streamflow in the Poudre River.

Effects to species of concern are described as “minor,” “moderate,” or “major” based on the following criteria. “Minor” is used when the impacts would be at low levels and may not have a noticeable effect on species of concern or their populations. Minor effects include temporary impacts during construction. Minor effects typically are short-term. “Moderate” is used when impacts to species of concern would affect individuals or small groups of species of concern, but would not affect populations or large areas of habitat. “Major” is

used when impacts to populations or large areas of species of concern habitat would occur. Major effects typically are long-term. The term “no impact” is used when there are no changes to existing conditions from the alternatives. Methods for evaluating effects to species of concern are described in the Species of Concern Technical Report (ERO 2008d).

4.16.1.1 Alternative 1—No Action

The No Action alternative involves the use of gravel pits from which aggregate has been extracted. These sites would eventually be converted to water supply storage. Temporary impacts to wetlands and riparian habitats would occur from constructing pipelines and ditches and improving canals to accommodate the No Action alternative. The impacts to wetlands and riparian habitats from the improvements to gravel pits and temporary impacts along pipelines, canals, and ditches have the potential to have minor short-term effects to species of concern associated with these habitats.

In addition, up to 69,200 acres of irrigated agricultural land would be dried up as a result of the No Action alternative (HDR 2007b). An estimated 1,384 acres of irrigated wetlands would dry up as a result of the No Action alternative (ERO 2008b). The No Action alternative would also result in a large-scale dry up of irrigation canals, ditches, and ponds. The habitat that would be dried up is generally low quality because it is supported by flood irrigation and is often subjected to dredging, tilling, and other disturbances. However, it is possible that losses of irrigated cropland and wetlands, as well as open water habitat, could affect some species of concern associated with these habitats. The exact location of the agricultural lands that would be dried up is not known. Depending on the location of the agricultural dry-up areas and the habitat provided, impacts could range from minor

short-term effects to major long-term effects. It was assumed that the No Action alternative would not affect streamflows in the Poudre River. There would be no effect to species of concern along the Cache la Poudre River under the No Action alternative.

It is possible that Preble's, ULTO, and CBP habitat may be disturbed or lost by conversion of gravel mines to water storage sites. Losses of irrigated wetland and riparian habitat would not likely affect these species. Conversion of gravel pits to water storage sites could have minor short-term effects on bald eagles. Created open water habitat could attract bald eagles, and have a minor long-term beneficial effect. Losses of irrigated agricultural land would not likely affect bald eagles.

Conversion of the gravel mines to water storage sites would not likely impact the black-tailed prairie dog, burrowing owl, or swift fox. Much of the dried-up agricultural lands would likely be replaced by upland grassland habitat, potentially providing new habitat, which would be a minor long-term beneficial effect for these species.

There could be minor effects to the common gartersnake and the northern leopard frog from the conversion of gravel mines to water storage sites. Also, the common gartersnake and the northern leopard frog could be adversely affected by the dry up of 1,384 acres of low- to moderate quality irrigated wetlands.

4.16.1.2 Action Alternatives

4.16.1.2.1 Preble's Meadow Jumping Mouse

Alternative 2 and Subalternative 4.1 would involve the permanent loss of 50 acres of known Preble's habitat, mostly in the southern portion of the proposed Glade Reservoir. This is considered a major long-term effect to Preble's. Temporary disturbance to 24 to 26 acres of Preble's habitat also

would occur. This is considered a minor short-term effect on Preble's. Potential disturbance of Preble's behavior due to increased noise and human presence, and physical harm to individual Preble's from construction machinery and future recreational activities at Glade Reservoir also could occur. This is considered a moderate long-term effect.

There would be no permanent impacts to Preble's habitat from Cactus Hill or Galeton reservoirs, or the SPWCP forebay and diversion under Alternative 3 and Subalternative 4.2. Temporary impacts to less than 1 acre of Preble's habitat from modifications of the Pleasant Valley pipeline would occur under Alternative 3 and Subalternative 4.2. These impacts are considered minor short-term effects.

Under Subalternatives 4.1 and 4.2, irrigated wetland and riparian habitat that would be dried up as part of the transfer of water from agricultural lands are unlikely to support Preble's; therefore, losses of these habitats would not likely affect Preble's.

Flow reductions on the Poudre River associated with the action alternatives are unlikely to affect Preble's. There are no known populations of Preble's on the Poudre River below Laporte.

4.16.1.2.2 Bald Eagle

Under Alternative 2 and Subalternative 4.1, about 0.9 mile of pipeline would be placed within 0.5 mile of a bald eagle nest, and portions of the pipeline would be located as close as 825 feet from the nest site. Pipeline construction would not take place during the bald eagle nesting season; therefore, there would be no effect to bald eagles as a result of pipeline construction. Glade Reservoir could provide additional summer foraging habitat for bald eagles, especially if stocked with fish.

Under Alternative 3 and Subalternative 4.2, Cactus Hill Reservoir could provide additional summer foraging habitat for bald eagles with development of

a fishery. Less than 1 acre of habitat within 0.5 mile of a bald eagle nest would be temporarily impacted by modifications of the Poudre Valley Canal. The modification would not take place during bald eagle nesting season; therefore, there would be no impact to bald eagles as a result of modification to the Poudre Valley Canal.

Under Subalternatives 4.1 and 4.2, the dry up of irrigated agricultural land would not likely affect bald eagles.

4.16.1.2.3 Ute Ladies' Tresses Orchid and Colorado Butterfly Plant

No ULTO or CBP were found during surveys of the Glade Reservoir and U.S. 287 study areas. No known populations of ULTO or CBP occur in any of the study areas and it is unlikely that ULTO or CBP occurs in the SPWCP pipeline or Glade to Horsetooth pipeline study areas. Although ULTO has been found near the Glade to Horsetooth pipeline, other surveys in the area have not found this species. The losses of agricultural land would not likely affect ULTO or CBP. Therefore, ULTO and CBP would not likely be adversely affected under the action alternatives.

Potential habitat for ULTO or CBP may occur in the sensitive riparian areas, including Fort Collins natural areas, which may be affected by changes in streamflow and stage. No populations of either species have been found in the sensitive riparian areas within the Cache la Poudre floodplain. If either ULTO or CBP occurs in the sensitive riparian areas, the populations may be affected by changes in streamflow and stage.

4.16.1.2.4 State Species of Concern

About 265 to 312 acres of black-tailed prairie dog habitat, and potential burrowing owl habitat, would be permanently affected under the action alternatives. All of the action alternatives would permanently impact 1,240 to 1,857 acres of swift fox

habitat. These impacts would be minor and long-term. Under Alternative 2, there would be a loss of 42 to 45 acres of wetlands and 7 acres of aquatic habitat. Alternative 3 would result in permanent impacts to 79 acres of wetlands. Impacts to wetland and aquatic habitat from the action alternatives would have minor long-term effects on the common gartersnake and northern leopard frog. Alternative 2 and Subalternative 4.2 would impact 26 to 29 acres of Bell's twinpod habitat due to the realignment of U.S. 287. Construction of the Carter pipeline also could impact Bell's twinpod. However, no surveys were conducted for Bell's twinpod in this area; therefore, the extent of potential impacts has not been determined.

The common gartersnake, northern leopard frog, smokey-eyed brown butterfly, two-spotted skipper, and American currant are dependent on wetland and/or riparian habitat for at least a portion of their life cycle and could be vulnerable to changes in the frequency of overbank flows on the Poudre River. Although the abundance of these sensitive species could be reduced in localized areas, abundant wetland and riparian habitat would remain along the Poudre River and no major changes in species composition or distribution are anticipated.

4.16.1.3 Mitigation Recommendations

Mitigation for effects to state species of concern is presented in Table 4-12. The mitigation for federally listed species is presented in Chapter 5 and in the reasonable and prudent measures and terms and conditions of the Biological Opinion (Appendix B).

Table 4-12. Summary of Recommended Mitigation for Impacts to Species of Concern for All Alternatives.

Species of concern	Alternative 1 No Action	All Action Alternatives	Alternative 2	Alternative 3	Subalternative 4.1	Subalternative 4.2
Black-footed ferret	Prairie dog colonies potentially impacted during construction of project components should be reevaluated prior to construction, and any new or expanded colonies of more than 80 acres should be surveyed for black-footed ferrets according to the protocol in effect at the time.					
Preble's meadow jumping mouse	None	The Service has concurred that construction footprints for the western U.S. 287 alignment, Carter pipeline crossing of the Big Thompson River, and the Glade forebay are unlikely to provide potential Preble's habitat (Service 2008). Prior to construction, habitat assessments for Preble's are recommended in any other potentially impacted areas of suitable habitat not currently known to support Preble's.	Compensatory mitigation will occur through enhancement of existing habitat and creation of new habitat in a 143-acre area below the proposed Glade Reservoir. Other key mitigation measures include: 1) protecting the riparian corridor south of the mitigation site through conservation easements; 2) when feasible, boring pipelines under the Poudre River floodplain to avoid surface impacts; 3) constructing pipeline crossings between November 1 and May 1 when Preble's is typically inactive; and 4) limiting the disturbance width of the pipeline to 60 feet within areas of Preble's habitat.	Same as all action alternatives.	Same as Alternative 2.	Same as all action alternatives.
Bald eagle		Potentially impacted areas should be reevaluated prior to construction for the presence of bald eagle nest and roost sites within the CDOW-recommended disturbance buffers in effect at that time.	No activities associated with pipeline construction should occur within 0.5 mile of the nest site from November 15 through July 31. To the extent possible, clearing and construction of pipelines and other facilities should be avoided within ¼ mile of the nest. No cottonwoods over 12 inches diameter at breast	Same as all action alternatives.	Same as Alternative 2.	Same as all action alternatives.

Species of concern	Alternative 1 No Action	All Action Alternatives	Alternative 2	Alternative 3	Subalternative 4.1	Subalternative 4.2
			height within 0.5 mile of the nest should be cut during pipeline construction. Specific mitigation measures would be determined in consultation with the Service.			
Colorado butterfly plant	Subject to mining permit requirements, surveys for CBP may be necessary. If CBP is found within the construction footprint, specific conservation measures would be developed in coordination with the Service.	Prior to construction, CBP habitat assessments and/or final surveys are recommended in areas not previously evaluated or where suitable CBP habitat occurs. If CBP is found within the impact area, specific mitigation measures will be determined in consultation with the Service. Conservation measures could include avoiding impacts by establishing a no construction zone around plants or protecting/enhancing adjacent or off-site habitat.				
Ute ladies'-tresses orchid	Same as CBP					
Black-tailed prairie dog	None	Prairie dogs potentially impacted should be relocated or exterminated prior to construction.	For the U.S. 287 realignment, in areas where avoidance of prairie dog colonies is not possible, CDOT would follow its guidelines for mitigating impacts.	Same as all action alternatives.	Same as Alternative 2.	Same as all action alternatives.
Swift fox	None	Construction activities should be avoided during swift fox breeding season (January to August) within swift fox range, in particular at the Galeton Reservoir site.				
Burrowing owl	None	Prairie dog colonies should be surveyed for burrowing owls prior to any work that would disturb them between March 15 and October 31. Where burrowing owls are present, prairie dog removal should be scheduled for November 1 to March 14. If burrowing owls are found within the construction footprint, nests should be left undisturbed during construction. If burrowing owls are found during preconstruction surveys, additional avoidance mitigation measures would be developed in coordination with the CDOW.				
Common gartersnake	Revegetate disturbed areas with native seed mixes, implement erosion control measures and a noxious	Mitigation proposed for wetlands and riparian habitat will benefit the gartersnake.				

Species of concern	Alternative 1 No Action	All Action Alternatives	Alternative 2	Alternative 3	Subalternative 4.1	Subalternative 4.2
	weed plan, and create wetland habitat. A combination of measures, such as the purchase of mitigation banking credits, preservation of high quality wetlands in the region and creation of wetlands could be used to mitigate for the estimated 1,384 acres of irrigated wetlands that would dry up.					
Northern leopard frog	Same as common gartersnake.	Same as common gartersnake.				
Smokey-eyed brown butterfly and two-spotted skipper	None	Same as common gartersnake.				
American currant	None	Same as common gartersnake.				
Bell's twinpod	None	None	If the Munroe Canal relocation option is chosen, surveys for Bell's twinpod should be conducted in appropriate habitat prior to construction. Recommended mitigation measures include avoiding dense populations and large patches of Bell's twinpod as much as possible. Where impacts are unavoidable, populations should be reestablished as much as possible after construction.	Potential habitat may occur in the Carter pipeline route east and south of Horsetooth Reservoir. Surveys of these areas should be conducted prior to construction.	Same as Alternative 2.	Same as Alternative 3.

4.17 RECREATION RESOURCES

Effects to recreation were an issue of concern expressed during scoping. Recreation resources in the study areas could be affected by project-related changes in streamflows and/or reservoir levels.

4.17.1 Methods

Impacts to recreation resources were analyzed using the best available information. The impact assessment was based on potential changes to recreational use and opportunity in the NISP study areas. No formal recreation/user surveys were conducted. Both water- and land-based recreation resources were inventoried. To the extent that recreational use had been quantified and was readily available, ERO used recreational visitor day or annual visitor days as the unit of measure. Otherwise, determinations on levels of recreational use were either semiquantitative or qualitative.

4.17.2 Alternative 1—No Action

The No Action alternative calls for most of the Participants to convert aggregate mining sites (gravel pits) to water supply storage once mining is complete. Once gravel production is complete and the pits are converted to water supply reservoirs, they could be stocked with fish and riparian habitat could be improved around the reservoirs, which may provide new fishing, hunting, canoeing, or swimming opportunities, or potentially improve opportunities for wildlife viewing. However, these gravel pits may be inaccessible to the public. Therefore, impacts to recreation are unknown at this time. The removal of irrigation from agricultural lands would not affect recreation because these lands are not open to the public.

4.17.3 Alternative 2—Proposed Action—Glade Reservoir and the SPWCP

4.17.3.1 Poudre River Recreation

Withdrawal of water from the Poudre River would be required for all action alternatives and the location of the diversion could have an effect on recreational activities. The two diversion points being considered are located at the Poudre Valley Canal and the Munroe Canal. The Munroe Canal diversion could only be used under Alternative 2 or 4 with Glade Reservoir. If the Munroe Canal is utilized during summer months, with Glade Reservoir, increased flows on the Poudre River may extend the season for rafting and kayaking opportunities between the Munroe Canal diversion and the Poudre Valley Canal, thereby extending the boating season on the Filter Plant Run. Fishing and other recreational opportunities are not expected to be affected by changes in flows on this reach.

Below the Poudre Valley Canal diversion through Fort Collins, flows on the Poudre River would be decreased under any action alternative. Although boating on reaches below this point is not a popular activity due to dams and diversions, the reach between Shields and Prospect Streets is used during the early summer months for kayaking, canoeing, and tubing. Those who enjoy canoeing this reach prefer flows of about 100 cfs. All action alternatives would reduce the canoeing season in this reach based upon the diminished flows. The boat chute, located just to the east of College Avenue, is currently used for kayaking, canoeing and tubing. A water craft course is currently being planned for this location and has a preliminary minimum design streamflow of 150 cfs. All action alternatives would reduce the streamflow on this reach, therefore reducing the boating season for the proposed water craft course. Fishing along this reach of the Poudre

River and in several of its associated ponds is growing in popularity and may be affected by streamflow changes that affect fish populations and pond water levels. Use of the Poudre River trail and nature observation are not expected to have more than minor impacts due to any diminished aesthetic qualities.

Reaches of the Poudre River below Fort Collins, east of I-25, do not currently receive major water recreational use. Boating is not a popular activity, due to the numerous diversions, dams, and lack of put-ins and take-outs. Fishing is also not a very popular activity, due to lack of public access, though the SWAs do receive some fishing use, which may be affected by reductions in streamflows that affect pond water levels. The Poudre River trail does have discontinuous sections along the river in various places on the east side of I-25, but it does not always parallel the river directly. Streamflows would also be diminished along this reach, but the reduced flows are not expected to affect current land-based recreation opportunities or experiences.

The SPWCP is common to all action alternatives, and requires the construction of a 21-acre forebay within the 67-acre Mitani-Tokuyasu SWA, located at the confluence of the Poudre and South Platte rivers. Waterfowl hunting is a popular activity at this location. The construction of this forebay would inundate the parking area and a portion of the access road, although it may provide improved habitat for waterfowl. Waterfowl hunting is also a popular activity on many private lands along the Poudre River and may be affected by reductions in streamflows that affect waterfowl habitat or populations.

4.17.3.2 Glade Reservoir

The proposed Glade Reservoir would inundate 429.9 acres of the Poudre River State Trust Land, northeast

of Fort Collins. This portion of the trust land is currently used for hunting on foot or horseback only during specified times of the year. Colorado State University (CSU) also uses this trust land for educational purposes. The access road currently used by CSU would be partially inundated by Glade Reservoir and would be rerouted by the District. A future agreement with Colorado State Parks or Larimer County to manage Glade Reservoir for public recreation could allow for water-based recreational activities. CDOW has also expressed interest in developing a new fishery at the reservoir. New recreational opportunities may include lake fishing, boating, camping, hiking, horseback riding, and biking. The KOA campground, located at the existing intersection of SH 14 and U.S. 287, may be impacted by both the realignment of U.S. 287 and the construction of Glade Reservoir, particularly if the reservoir is managed for recreation. No other impacts to recreation due to the realignment of U.S. 287 are anticipated.

4.17.3.3 No Contract Subalternative

The proposed pipeline would be an underground pipeline beginning at the Glade Reservoir dam, traveling along the east side of Horsetooth Reservoir, and then south to the connection with the SWSP. The pipeline location would come into contact with some forms of recreational uses (e.g., trails) along the corridor. These activities would be temporarily disrupted during construction, but would return to former uses upon completion of the pipeline.

4.17.3.4 Contract Subalternative

Water exchanged to or stored in Horsetooth Reservoir would not substantially affect water levels in May or June. Water elevations would begin to rise above existing conditions from July through January and would maintain existing conditions

during the rest of the year. These minor changes in reservoir levels would not adversely affect recreation on Horsetooth Reservoir.

If constructed, the Glade to Horsetooth pipeline would travel from the Glade Reservoir dam to the northern end of Horsetooth Reservoir. The pipeline would come into contact with dispersed forms of recreational uses along the way. Activities along this alignment would be disrupted temporarily during construction, but would return to former uses upon completion.

4.17.4 Alternative 3—Cactus Hill Reservoir and the SPWCP

4.17.4.1 Poudre River Recreation

Effects on recreation associated with the Poudre River would be similar to those described for Alternative 2. The Munroe Canal could not be used as a secondary point of diversion to fill Cactus Hill Reservoir; therefore, there would be no additional flows associated with Alternative 3 to extend the boating season into August for the Filter Plant Run. Alternative 3 would have greater flow reductions than Alternative 2 because Cactus Hill Reservoir (180,000 AF) is larger than Glade Reservoir (170,000 AF) to compensate for increased evaporation (Sections 4.2.1.1 and 4.3.5).

4.17.4.2 Cactus Hill Reservoir

Most of the Cactus Hill Reservoir site is owned by Anheuser-Busch and is not open for public use. It is used for disposal of wastewater associated with beer production. Some areas of the Cactus Hill Reservoir site are privately owned by other landowners, and are used for agricultural purposes such as crop production and horse and cattle grazing. No public recreation currently occurs on the site. Construction of the proposed Cactus Hill Reservoir could provide

a new fishery and improve riparian habitat, which may improve waterfowl and small game hunting if public access is provided. No other impacts to recreation are anticipated at this site.

4.17.4.3 No Contract Subalternative

The effects of the Reclamation No Contract Subalternative for Alternative 3 would be the same as Alternative 2 except the pipeline would run between Cactus Hill Reservoir and the SWSP. This extension of the pipeline would increase the length of the corridor; however, no significant permanent additional recreational impacts would result because the extension would cross primarily private lands. This pipeline would temporarily impact the Poudre River trail where it intersects, northwest of Fort Collins. The pipeline would also cross the Poudre River near this same location, however it is expected that the design and placement of this pipeline would not prevent any future recreational boating opportunities.

4.17.4.4 Contract Subalternative

A pipeline would run between Cactus Hill Reservoir and Horsetooth Reservoir. The pipeline would cross primarily private lands. This pipeline would temporarily impact the Poudre River trail, northwest of Fort Collins. The pipeline also would cross the Poudre River near the same location; however, it is expected that the design and placement of this pipeline would not prevent future recreational boating opportunities.

4.17.5 Alternative 4—Glade or Cactus Hill Reservoir and SPWCP and Agricultural Transfers

4.17.5.1 Poudre River Recreation

Poudre River recreation would be affected the same as for Alternative 2 or 3, dependent upon the reservoir.

4.17.5.2 Glade or Cactus Hill Reservoir

Alternative 4 has two subalternatives for reservoir storage of 170,000 AF (Glade Reservoir—Subalternative 4.1) or 180,000 AF (Cactus Hill Reservoir—Subalternative 4.2). The effects of the proposed Glade Reservoir in Alternative 4 would be the same as Alternative 2. The effects of the proposed Cactus Hill Reservoir in Alternative 4 would be the same as Alternative 3.

4.17.5.3 Galeton Reservoir (20,000 AF)

Although smaller in volume and surface size than in Alternatives 2 and 3, the Galeton Reservoir and forebay sites under Alternative 4 would have the same effects to recreation as Alternatives 2 and 3.

4.17.5.4 Agricultural Transfer

The transfer of agricultural water would not impact recreation resources.

4.17.5.5 No Contract Subalternative

The effects of the Reclamation No Contract Subalternative of Alternative 4 would be the same as Alternative 2.

4.17.5.6 Contract Subalternative

The effects of the Reclamation Contract Subalternative of Alternative 4 would be the same as Alternative 2.

4.17.6 Mitigation

Utilization of the Munroe Canal diversion, under Alternative 2 or 4, with Glade Reservoir, would provide a potential recreational boating benefit to the Filter Plant Run by potentially extending the recreational boating season.

The District would seek an agreement with the Lake Canal Company to move diversions from the Lake Canal intake on the Poudre River near College Avenue to the Timnath Reservoir Inlet Canal about 3 miles downstream. On average, moving the diversions from the Lake Canal downstream will add about 50 cfs to the Poudre River for 6 weeks from late May to early July.

The CDOW has requested some components be considered in the design of the Galeton forebay that may minimize impacts to Mitani-Tokuyasu and could actually improve the recreational experience at the SWA. Dependent upon the design of the forebay and measures taken to preserve or enhance the Mitani-Tokuyasu SWA, there may be only minor negative impacts to visitation primarily during construction and there could be benefits to the recreational experience at Mitani-Tokuyasu resulting from improved habitat. The District will continue to provide public access to the SWA and would provide substitute facilities comparable to any existing facilities that would be lost at the SWA because of the construction and operation of the SPWCP. These mitigation measures are discussed in greater detail in Chapter 5.

4.18 CULTURAL RESOURCES

Effects to cultural resources were identified as an issue during scoping. Construction disturbance associated with the alternatives could adversely affect cultural resources.

4.18.1 Methods

Each cultural resource identified within the APE was evaluated for its potential to be listed in the NRHP. Prehistoric, historic, and traditional cultural properties are considered significant if they are eligible for listing in the NRHP.

Many of the previously documented cultural resources within the APE, and all of the potential cultural resources identified during the Class I reconnaissance survey, have not been formally evaluated for the NRHP. Sites that are listed as “needs data” or unevaluated require reassessment for the NRHP and ultimately concurrence of eligibility from the SHPO. This assessment will occur under the Section 106 process as stipulated for under the PA (Appendix C).

4.18.2 Effects Common to All Action Alternatives

Construction of new reservoirs has the potential to adversely affect cultural resources. Direct effects include construction of access roads, borrow pits, transmission lines, pipelines, and dam facilities. Dam construction will involve the use of borrow from within a reservoir footprint, but no dredging will occur. The inundation of cultural resources is an indirect effect that can be either adverse or beneficial, depending on the type of cultural resource under consideration, and is ultimately determined through consultation with SHPO. Adverse effects through erosion can occur to sites located in the area of oscillating shoreline during the cyclical period of drawdown and filling. The loss of access to these cultural resources for scientific or cultural purposes may also be considered an adverse effect. Beneficial effects of inundation occur to sites not subject to shoreline erosion and preserved by the silting and anaerobic effects of being located at the

reservoir bottom. Indirect adverse effects to cultural resource sites also are possible as a result of increased visitation by the public. Increased exposure of sites contributes to the illicit collection of artifacts, unauthorized excavation of archaeological material, and potential erosion from facility development. Cumulative adverse effects could occur from any future residential, commercial, and recreation development that may occur near the reservoirs.

4.18.3 Alternative 1—No Action

Under the No Action alternative, the Participants would seek sources of new water supply from the development of new reservoirs, enlargement of existing reservoirs, and the conversion of existing gravel pits along watercourses to reservoirs. Adverse effects to cultural resources would be expected from the construction of new reservoirs and the enlargement of existing reservoirs. The conversion of gravel pits to water reservoirs would not likely result in adverse effects to cultural resources because any disturbance to cultural resources would have occurred during gravel mining. Each potential project undertaken by a Participant under the No Action alternative would be subject to individual review by federal agencies depending on the action taken and applicable federal environmental regulations. These individual projects subject to federal actions would be reviewed for compliance under the NHPA and effects to cultural resources would be evaluated at the time of any required federal agency action.

4.18.4 Alternative 2—Proposed Action—Glade Reservoir and the SPWCP

4.18.4.1 Glade Reservoir

Direct effects from reservoir inundation would occur to two known cultural resources located within the maximum pool elevation of Glade Reservoir. Consultation with SHPO will determine whether the effect is adverse or beneficial. Site 5LR300 (KOA Campground Burials) is currently listed as field “needs data” and is potentially eligible for listing in the NRHP. Further evaluation is required before an eligibility assessment can be made. An unrecorded segment of site 5LR1327 (Rex Branch of the Colorado & Southern/Burlington Northern Railroad) crosses the proposed reservoir pool.

Indirect effects could occur to an additional 14 cultural resources determined or recommended eligible for listing in the NRHP (Table 3-26). Another eight cultural resources listed as “needs data” (one resource) or have not been assessed (seven resources) for eligibility have the potential to be eligible for the NRHP pending future evaluation (WCRM 2007). These cultural resources are located within the 1-mile buffer area surrounding Glade Reservoir. An additional 12 cultural resources have been recommended not eligible; a DOE from SHPO is required for these sites. Assuming SHPO concurs with the field recommendations, no further evaluation would be necessary.

In order to better estimate the potential for unknown cultural resources within Glade Reservoir, the results of the Class I reconnaissance survey were used to extrapolate potential archaeological sites within the reservoir footprint. Reconnaissance inventory resulted in the identification of 34 potential archaeological sites in an area of 1,300 acres (1 site: 38 acres) using a 328-foot (100-meter) survey

interval. The reconnaissance inventory extrapolated to the total reservoir footprint area of 1,685 acres resulting in a total of about 85 archaeological sites that could be expected within the reservoir footprint or a site to acres ratio of 1:20 (doubling the number of estimated sites to compensate for a survey of interval of 66 feet (20 meters)). Conservatively, the number of NRHP eligible sites is estimated to be one-third of the total number or 35 cultural resources.

4.18.4.2 Galeton Reservoir

Direct effects would occur to 15 known cultural resources located within the maximum pool elevation of Galeton Reservoir. Nine cultural resources (all prehistoric archaeological sites) are listed as field “needs data” and require additional evaluation before an eligibility recommendation can be provided. Site 5WL4095 is another prehistoric archaeological site with an official determination of “needs data”; further evaluation is required before an eligibility recommendation can be provided. Two sites have not been assessed for eligibility and would also require additional evaluation. One site has received a determination of not eligible; no further evaluation is required (5WL233). Finally, site 5WL4094 is an isolated find that, by definition, is not eligible for the NRHP (WCRM 2007).

Indirect effects to seven eligible resources located within the 1-mile buffer surrounding the reservoir pool are possible if development were to occur near the reservoir (Table 3-27). All seven are historic engineering resources. An additional 16 cultural resources are listed as field “needs data,” including Centennial Farms, which require additional evaluation before an eligibility determination can be made. Five cultural resources have been recorded, but have not been assessed for their eligibility. Two sites have been recommended not eligible and a DOE from SHPO is required for these sites;

assuming concurrence from SHPO, no further work is necessary. Five sites have determinations of not eligible and no further evaluation is required.

Reconnaissance inventory resulted in the identification of 18 potential archaeological sites in an area of 1,250 acres (about the size of the 20,000 AF reservoir footprint) using a 328-foot (100-meter) survey interval or a 1:70 ratio. Factoring a shorter survey interval and the expected number of sites within the 20,000 AF reservoir footprint could result in about 36 sites (1:35). About 12 of these sites are estimated to be eligible for the NRHP. The reconnaissance inventory extrapolated to the 40,000 AF reservoir footprint area of 1,765 acres and doubling the number of estimated sites to compensate for a survey of interval of 66 feet (20 meters), a total of about 50 archaeological sites (1:35) could be expected within the reservoir footprint. Conservatively, the number of NRHP eligible sites is estimated to be one-third of the total number or 17 cultural resources.

4.18.5 Alternative 3—Cactus Hill Reservoir and the SPWCP

4.18.5.1 Galeton Reservoir

The effects associated with construction of Galeton Reservoir under Alternative 3 would be the same as the Proposed Action.

4.18.5.2 Cactus Hill Reservoir

Construction of Cactus Hill Reservoir would require, in addition to reservoir facilities, the realignment of three Weld County roads and two powerlines owned by PRPA.

At this time, no direct effects would occur to cultural resources within the maximum pool elevation of Cactus Hill Reservoir. Cultural resources have not

been identified to date within the maximum pool elevation.

Indirect effects to 83 cultural resources located within the 1-mile buffer surrounding the reservoir pool are possible if development were to occur near the reservoir (WCRM 2007). Of these known cultural resources, 23 are eligible for the NRHP (Table 3-28). Of the remaining 60 cultural resources, 55 have been determined not eligible and no further evaluation is necessary. Two sites that have not been assessed and one that is recommended “needs data” requires additional evaluation before an eligibility recommendation can be made. Finally, two sites are recommended as noncontributing sites to an otherwise eligible district; review and consultation is required with SHPO and assuming concurrence, no further evaluation would be required.

Reconnaissance inventory resulted in the identification of 16 potential archaeological sites in an area of 1,000 acres (1:63) using a 328-foot (100-meter) survey interval; extrapolated to the total reservoir footprint area of 4,071 acres and doubling the number of estimated sites to compensate for a survey of interval of 66 feet (20 meters). About 131 archaeological sites could be expected within the reservoir footprint, or a site to acres ratio of 1:31. Conservatively, the number of NRHP eligible sites are estimated to be one-third of the total number or about 44 cultural resources.

4.18.6 Alternative 4—Glade or Cactus Hill Reservoir and SPWCP and Agricultural Transfers

4.18.6.1 Galeton Reservoir

The effects associated with construction of Galeton Reservoir under Alternative 4 would be the same as

the Proposed Action. However, Galetton Reservoir would be constructed to hold 20,000 AF, a reduction of 20,000 AF from the Proposed Action. The reduction in size would affect three fewer cultural resources (5WL231, 5WL235, and 5WL4095) and seven fewer potential sites identified during a reconnaissance survey conducted by WCRM (2007).

4.18.6.2 Glade Reservoir

The effects associated with construction of Glade Reservoir under Subalternative 4.1 would be the same as the Proposed Action.

4.18.6.3 Cactus Hill Reservoir Subalternative

The effects associated with construction of Cactus Hill Reservoir under Subalternative 4.2 would be the same as Alternative 3.

4.18.7 Reclamation Subalternatives

4.18.7.1 No Contract Subalternative

The effects associated with the No Contract Subalternative would be the same as construction of Glade or Cactus Hill reservoir (Alternative 2 or Alternative 3). Construction of either Glade or Cactus Hill reservoir under this subalternative would involve construction of a pipeline. Pipeline corridors have not been reviewed for cultural resources. If either of these subalternatives is chosen, Section 106 compliance per NHPA would be implemented in order to identify unknown cultural resources. Impacts to cultural resources can be potentially avoided by rerouting pipelines.

4.18.7.2 Contract Subalternatives

The effects associated with the Contract Subalternative would be the same as construction of Glade or Cactus Hill reservoir (Alternative 2 or Alternative 3). Selection of either reservoir

alternative would involve a pipeline between the reservoir and Horsetooth Reservoir. Pipeline corridors have not been reviewed for cultural resources. If either of these subalternatives is chosen, Section 106 compliance per NHPA would be implemented in order to identify unknown cultural resources. Impacts to cultural resources can be potentially avoided by rerouting pipelines.

4.18.8 Mitigation

Mitigation of impacts to cultural resources are discussed in detail in the Programmatic Agreement (Appendix C) and as summarized in Chapter 5.

4.19 AESTHETICS AND VISUAL RESOURCES

Issues of concern identified during scoping were the potential effect to existing visual quality near the reservoir sites, the visual impact of relocating U.S. 287, and the impact to scenic resources from hydrologic changes.

4.19.1 Methods

Potential effects to visual quality considered temporary and permanent changes in the visual quality due to reservoir and facility construction, and the impact to the scenery from nearby observation points (OPs) where a reservoir and dam would be visible. The visual quality assessment for the existing and proposed sites of the alternative dam and reservoir locations consisted of two separate assessments:

- A line-of-sight/viewshed analysis, called a visibility study, identified areas with views of the alternative dams and reservoirs. Using digital terrain modeling, a polygon of points was set at the top of the dam elevation and in the

shape of the reservoir. If any point could see the surrounding terrain within a 2.5-mile radius of the reservoir's edge, a shaded area was created. The shaded areas away from the reservoir therefore identified locations from which the reservoir would be visible.

- A scenic quality assessment evaluated the existing scenic quality in the study areas. This portion of the assessment is a field measurement of the physical characteristics, or elements, of scenic quality. These elements include landform types, rock form types and sizes, water form types, artificial form types and quantities, the size of the field of view (referred to as containment), and the color and texture variations.

The visibility analysis was conducted using digital elevation data to estimate reservoir and dam visibility from surrounding lands within a 2.5-mile radius from the reservoir site. At distances beyond 2.5 miles, visibility would diminish, as would impacts to scenic quality. Potential visual quality effects at reservoirs and streams were evaluated based on changes in reservoir water elevations and streamflow.

4.19.2 Glade Reservoir

Visual impacts in the Glade Reservoir study area vary with the OP location relative to the elevation of the top of the dam and the distance from the reservoir. The scenic quality of the views from two locations below the top of the dam would be reduced due to the proximity of the viewer to the face of the dam. Views from SH 14, represented by two OPs, would be mostly perpendicular to the direction of travel. The viewer would have limited time while traveling in a vehicle to see the face of the dam. The views from these OPs include houses, ranch

outbuildings, fences, overhead utilities, some concrete drainage structures, and a convenience store with gasoline pumps near SH 14, and within the views from these OPs. These artificial forms also partially obscure views of the dam. Therefore, the scenic quality from SH 14 views would remain the same as the existing conditions.

The scenic quality of views from locations below the top of the dam would remain unchanged from existing conditions because these locations would have views of the dam face either partially or completely obscured by vegetation and houses or agricultural outbuildings. Additionally, as viewed from these OPs, the dam is a relatively small object. These locations are relatively far from the dam.

The scenic quality from residences and a small portion of U.S. 287 north of the reservoir would increase due to the presence of water. Color and texture variety would increase with the addition of water in these views.

At Glade Reservoir, the OPs representing the highest scenic quality would be located north of the proposed dam and reservoir. This is due to the high visibility of large rock outcrops to the east, northeast, and southeast; the variety of landforms; and the absence of artificial forms and containment. The OPs with the lowest, or unchanged, scenic quality would be located south and southwest of the proposed dam and reservoir due to the presence of additional artificial forms in these views, particularly the face of the dam.

4.19.3 Galeton Reservoir

Similar to existing reservoir dams in the vicinity, the Galeton dam would be similar to the surrounding landforms with long horizontal lines. The dam would not "skyline" from most of the OPs. Other dams in the study area of varying sizes are also

visible from some of the OPs; therefore, the proposed Galeton dam would not be out of context within the study area.

Visual impacts to the Galeton Reservoir study area would vary. The scenic quality of views from two of the three OPs below the top of the dam and southeast of the reservoir would remain unchanged from existing conditions. This would be due to the low horizontal shape of the dam complimenting the surrounding landforms, the relatively small size of the dam in these views, and partial obscurity of the dam by a few trees. The scenic quality of the other OP in this same area would be reduced due to the proximity to the dam, eliminating the existing long-distance views to the northwest, and the dominant, relatively large presence of the artificial form of the dam.

The scenic quality of views from OPs along SH 14 and vicinity, north and northwest of the reservoir, would be increased due to the presence of water. The reservoir would be mostly visible from all of these OPs, while only a small portion of the top of the dam, a horizontal line, would be visible at a greater distance.

The Galeton dam and reservoir would not be visible from any municipalities or public recreational developments. Although partially visible from multiple small areas within the Pawnee National Grasslands, the areas of visibility are void of any development except fences and a few two-track roads.

At Galeton Reservoir, the OPs representing the highest scenic quality would be located north and northwest of the proposed dam and reservoir. This is due to the visibility of distant mountain ranges and the presence of water from the new reservoir. The OPs with the lowest, or unchanged, scenic quality would be located southeast of the proposed dam and

reservoir. These OPs would both be below the elevation of the top of the dam.

4.19.4 Cactus Hill Reservoir

Visual impacts to the Cactus Hill Reservoir study area would vary with the OP location relative to the dam location and the elevation of the top of the dam. The scenic quality of views from south and southeast of the dam would be reduced due to the presence of the relatively large artificial form of the dam face. At residential and road locations west of the dam and reservoir site, the high scenic quality would be slightly reduced. The scenic quality of this location would benefit from the presence of a water feature, but would more effectively be reduced by the presence of multiple artificial forms such as the roads, spillway, and other facilities associated with the Cactus Hill Reservoir alternative.

The Cactus Hill Reservoir and Dam would not be visible from any municipalities or public recreational developments. However, the dam would be visible from the private Black Hollow Recreation Area to the south. The scenic quality from within this private recreation area would be reduced. Views from the water surface and recreation areas at Cobb Lake and the SWA adjacent to Cobb Lake would not be affected because the Cactus Hill Reservoir site would not be visible from Cobb Lake or the vicinity. Although visible from SH 14 south of the reservoir, views of the dam would not be in the direction of travel. Therefore, views of the dam would be relatively short and require the viewer to look nearly perpendicular to the road alignment.

At Cactus Hill Reservoir, the OP representing the highest scenic quality would be located north of the proposed dam and reservoir. This is due to the visibility of distant mountain ranges and the presence of water in the new reservoir. The OPs with the lowest or unchanged scenic quality would

be located south of the proposed dam and reservoir. These OPs would be below the top of the dam.

4.19.5 Effects Common to Both U.S. 287 Realignment Alternatives

Pavement type and width, ditch configurations, shoulders, and striping for both alternatives would be the same. Therefore, the roadway facilities of both alternatives would have the same visual characteristics.

The southern 6 miles of both alignment alternatives are the same. Both are located in the Holcim Mine. This portion of the alignment alternatives is an extremely disturbed landscape due to surface mining operations for the extraction of limestone. Although the Holcim Mine site is being revegetated, the landforms created during mining operations are in significant contrast with adjacent undisturbed landforms. Revegetation is composed of herbaceous plants with a contrasting color and texture to the adjacent undisturbed plant communities. Therefore, neither alignment alternative within the Holcim Mine site would create noticeable contrasts.

Vehicles traveling on the western or northern realignment alternative would be noticeable from all visibility areas in the northern, eastern, and southern portions of the study areas. Vehicles traveling on the realignment alternatives also would introduce visible light (from headlights) at nighttime. The presence of vehicles on the realignment alternatives would reduce the scenic quality of portions of the study areas. Maps of the western and northern realignment alternatives are included in the Visual Resources Comprehensive Technical Report for the U.S. 287 Realignment Alternatives (ERO 2008i).

Relative to the section of U.S. 287 that would be replaced, the scenic quality would also be reduced for travelers on the alternatives through the Holcim

Mine site due to: landform, color, and texture contrasts with adjacent landscapes; the absence of mountain views to the west; the absence of variety in rock forms; and the presence of artificial forms to the east such as numerous residences and town/city and utility developments.

4.19.6 U.S. 287 Existing Alignment

Under the No Action alternative, U.S. 287 would not change; therefore, visual resources would not change.

4.19.7 U.S. 287 Western Realignment

This alternative would be the shortest length of new road (7.9 miles), but would create a cut through the hogback formations between the Holcim Mine and U.S. 287. The highway cut would create a significant contrast in most scenic quality elements. The continuity of the existing hogback formation would be interrupted, causing a noticeable change in landform. The cut also would introduce the artificial form of the roadway facility and contrasts in rock form, color, and texture. The cut would be visible from most of the study areas and many locations west of the hogback.

North of the Holcim Mine and east of the hogback formation, this alternative would cross a high plains prairie landscape. Although the road facility would introduce an artificial form to this portion of the study area, multiple large power transmission lines and dirt roads exist in this vicinity. Additionally, the alternative would have relatively small cuts and/or fills due to the nearly flat topography of the prairie.

Scenic quality would be significantly reduced by the western alignment alternative due to the visible contrasting changes in landform, rock form, color, and texture. Visibility of the contrasts would extend

beyond the study area predominantly to the west and would affect travelers on the highway.

4.19.8 U.S. 287 Northern Realignment

This alternative would be the longest length of new road (12.8 miles), and would avoid any disturbance to the hogback formation. North of the Holcim Mine, and east of the hogback formation, this alignment would traverse high plains prairie landscapes. Although the road facility would introduce an artificial form to this portion of the study area, multiple large power transmission lines, many fences, and dirt roads exist in this vicinity. Additionally, the alternative would have relatively small cuts and/or fills due to the nearly flat topography of the prairie. Because very few OPs exist in the northern portion of the study area, the potential negative visual effects from vehicle headlights, and the presence of vehicles during daytime, would be seen by few, if any, viewers.

Scenic quality would remain unchanged in some locations and would be reduced in most locations. Unchanged scenic quality locations would be in the northernmost portion of the study area due to the presence of views of the mountains to the west. Reduced scenic quality locations would be in and near the Holcim Mine. This portion of the study area includes many existing artificial forms; substantial contrasts in landforms, color, and texture; and almost complete obscurity of mountain views to the west. However, visibility of the alternative is largely limited to the study area.

4.19.9 Visual Quality Effects Common to All Alternatives During Construction

Impacts on scenic quality common to all dam and reservoir alternatives during construction would be

the generation of dust, the presence of construction equipment, potential construction nighttime lighting, and areas of vegetation clearing. Dust would be emitted from earthmoving activities, construction vehicles, and equipment; and from areas within the construction zone that have been disturbed or where excavated material is stockpiled. This “fugitive” dust could temporarily distract from, or partially obscure, existing views.

Construction of Glade Reservoir would take up to 60 months, Galeton Reservoir would take up to 32 months, and Cactus Hill Reservoir would take up to 50 months.

Installation of the underground pipelines would significantly impact visual resources during construction. Although similar to the effects from the construction of the reservoirs, pipeline installation visual effects would occur beyond the reservoir study areas. The duration of pipeline construction work is presently unknown.

4.19.10 Visual Quality Effects Common to All Alternatives

In addition to visual quality effects for each of the three alternative dam and reservoir locations, potential visual effects would occur from the operation of new reservoirs and at Horsetooth Reservoir. Changing water surface elevations typically result in exposing more shoreline, increasing distances between lake-edge recreation facilities and the water’s edge, and decreasing the area of surface water. Summer reservoir water elevations are most important because the majority of visitation occurs from May through August. Potential effects to visual quality at new and existing reservoirs are discussed below for each alternative.

For all action alternatives, the Galeton forebay would be constructed in the existing Mitani-

Tokuyasu SWA, approximately 9 miles south of the proposed Galetton Reservoir, affecting the scenic quality of the SWA and vicinity. A majority of the SWA would be replaced by the forebay. Scenic quality would be significantly reduced at the location of the proposed forebay. Additionally, all of the action alternatives would affect the scenic quality of Horsetooth Reservoir. Fluctuations of Horsetooth Reservoir's pool elevation would change from existing conditions. Changing water surface elevations typically results in exposing more shoreline, increasing distances between lake-edge recreation facilities and the water's edge, and decreasing the area of surface water. Summer reservoir water elevations are most important because the majority of visitation occurs from May through August. Scenic quality at Horsetooth and Carter reservoirs would be reduced to longer periods of larger areas of exposed banks.

4.19.11 Visual Quality Effects Associated with Each Alternative

4.19.11.1 *Alternative 1—No Action*

Visual effects vary with each Participant group and are speculative at this time; however, there would be a visual change on up to 69,200 acres of irrigated lands where irrigated crops would be changed to rangeland or dryland crops.

4.19.11.2 *Alternative 2—Proposed Action—Glade Reservoir and the SPWCP*

Visual effects would include the visual effects for the Glade and Galetton reservoirs and effects common to all action alternatives as described in previous sections.

4.19.11.3 *Alternative 3—Cactus Hill Reservoir and the SPWCP*

Visual effects would include the visual effects for the Cactus Hill and Galetton reservoirs and effects common to all action alternatives as described in previous sections.

4.19.11.4 *Alternative 4—Glade Reservoir and SPWCP with Agricultural Transfer Lands*

Visual effects would include the visual effects for the Glade and Galetton reservoirs, and effects common to all action alternatives as described in previous sections. Additionally, there would be a visual change on about 17,137 acres of irrigated lands where irrigated crops would be changed to dryland crops and rangeland.

4.19.12 Mitigation

Short-term effects to visual resources will be reduced by controlling fugitive dust and locating staging areas near sites either mostly or completely obscured from a majority of the OPs and homes with views of the dam and/or reservoir alternatives. The long-term effects of visual resources would be mitigated by measures to minimize the contrasts and decreased visibility between the proposed dams and OPs for any of the action alternatives. The District will coordinate with CDOT to minimize adverse visual effects of the relocation of U.S. 287 on the road cuts, rock cuts, fills, and retaining walls. These mitigation measures are presented in detail in Chapter 5.

4.20 TRAFFIC AND TRANSPORTATION

The effects on traffic and transportation were raised as an issue of concern during scoping. Construction

of Glade and Cactus Hill reservoirs would require the relocation of U.S. 287 and Weld County roads, respectively.

4.20.1 Methods

Effects to traffic and transportation were assessed based on best available existing information obtained from the Weld County Public Works Department and CDOT website. The traffic and transportation assessment focused on the three proposed reservoir sites because these inundated areas have the greatest potential to affect traffic and transportation.

4.20.2 No Action Alternative

The conversion of gravel pits to water supply storage could cause temporary increases in construction traffic in the vicinity of the gravel pits, but would not have long-term impacts to the roadway network.

4.20.3 Galeton Reservoir

The SPWCP and Galeton Reservoir are common to all action alternatives. During construction of the dam and reservoir, a minimal increase in traffic, associated with workers accessing the site, can be expected on the roads in the immediate vicinity. Trucks and heavy vehicles necessary for site development would likely remain on-site for the duration of construction and would not contribute to daily trip generations. It is anticipated that any traffic associated with the Galeton Reservoir and dam would be minimal. In general, only vehicles associated with the daily operation and maintenance of the facility are expected to access the site. Public recreational activities are not planned for Galeton Reservoir. It is not expected that this site would generate enough traffic to warrant any improvement

to the area roadway network. The proposed location for Galeton Reservoir is such that it would not infringe on or disturb any existing public roadways. Access to the reservoir would need to occur from one of the existing roads surrounding the site. This may include an extension of one of the existing roadways or construction of a private drive or roadway for purposes of accessing and maintaining the facility. A permit must be obtained to take access from either a local road (Weld County) or from the state highway (CDOT). In Weld County, the requirements of any new development are determined on a case-by-case basis. A Traffic Impact Study would be required prior to approval of the development to be constructed.

4.20.4 Alternative 2—Proposed Action—Glade Reservoir and the SPWCP

4.20.4.1 Construction and Operation

During construction of the Glade Reservoir and dam, a minimal increase in traffic associated with workers accessing the site could be expected on the roads in the immediate vicinity. Trucks and heavy vehicles necessary for site development would likely remain on-site for the duration of construction and would not contribute to daily trip generations.

It is anticipated that any traffic associated with the operation of Glade Reservoir and dam would be minimal. In general, only vehicles associated with the daily operation and maintenance of the facility are expected to access the site. If the Glade Reservoir site includes public recreational activities, then area roads could experience a slight seasonal increase in traffic volumes, and the site could see sizeable increases in traffic seasonally associated with recreation.

4.20.4.2 Traffic Impacts

Construction of the Glade Reservoir and dam would inundate a portion of the existing U.S. 287 between Ted's Place and Owl Canyon Road. As a result, a portion of the highway between Owl Canyon Road on the north and Overland trail on the south would be realigned to maintain this connectivity. Assuming that the speed limit would not change, the difference in travel times should not change by more than a few minutes. Other traffic-related impacts associated with the realignment would include:

- Existing traffic patterns are not expected to change; therefore, reduced traffic volumes are anticipated along the section of SH 14 where the two highways will no longer run concurrently (between Overland trail and Ted's Place).
- The existing U.S. 287/SH 14 intersection (at Ted's Place) is under stop control for the west leg (SH 14) of the intersection. It is expected that this traffic control would be sufficient for the realignment as well (Table 4-13).
- The Bonner Spring Ranch Road would be affected by the realignment and the placement of Glade Reservoir. Alternative access would be provided.
- Big Ridge Way would be affected by the realignment and the placement of Glade Reservoir. Alternative access would be provided.
- Access to a CSU/State Land Board parcel west of Glade Reservoir would be affected. Alternative access would be provided.
- Traffic volumes along U.S. 287 could increase if public recreational activities are developed for Glade Reservoir.

Table 4-13. Existing Travel Distances Compared to Potential U.S. 287 Northern and Western Realignments.

Alignment Option	Existing Mileage	Potential New Mileage
Western Alignment	10.47	7.78
Northern Alignment	10.47	11.48

Note: Measured from southern start of either new road to the Owl Canyon Road intersection.

It is anticipated that the Glade Reservoir and dam would not significantly impact traffic volumes on the existing roadway network. If recreational activities are provided at this site, minor seasonal fluctuations in vehicle volume could be anticipated. Adequate access roads and parking would need to be provided to accommodate the public.

The realignment of U.S. 287 would not change the highway designations or the access control for either U.S. 287 or SH 14. The final design of the realignment would meet all CDOT and Larimer County requirements (Chapter 5).

4.20.5 Alternative 3—Cactus Hill Reservoir and the SPWCP

4.20.5.1 Construction and Operation

During construction of the Cactus Hill Reservoir and dam, a minimal increase in traffic associated with workers accessing the site could be expected on the roads in the immediate vicinity. Trucks and heavy vehicles necessary for site development would likely remain on-site for the duration of construction and would not contribute to daily trip generations.

4.20.5.2 Traffic Impacts

Cactus Hill Reservoir would directly impact local Weld CR 15, 19, and 90. WCR 15 is proposed to be realigned approximately 1 mile east of the existing

alignment, generally following the eastern edge of the reservoir. Based on the low traffic volume of WCR 15, impacts to existing traffic using this road would be minimal.

To accommodate Cactus Hill Reservoir, a portion of WCR 19 would be vacated between Black Hollow Reservoir and WCR 94. Similarly, a section of WCR 90, approximately 4 to 5 miles in length, also would be inundated. In lieu of these existing routes, a new road would be built along the west side of the reservoir. This new road would extend WCR 23 north of SH 14 and meander toward the reservoir and tie into the existing WCR 19 approximately 1 mile south of WCR 96. A short segment would be built to connect the southern portion of WCR 19 (at Black Hollow Reservoir) to the new roadway. Travel times for vehicles using WCR 19 would increase a few minutes between SH 14 and WCR 96. Vehicles using WCR 90, however, would travel around the proposed Cactus Hill Reservoir via the new roadways and the existing WCR 96, which would add approximately 8 miles to their current route, increasing travel times for these vehicles by about 10 minutes. It is anticipated that the Cactus Hill Reservoir and dam would not have a significant impact to daily traffic volumes on the existing roadway network, but it would impact travel times for some local traffic.

A Traffic Impact Study would be required prior to approval of the facilities to be constructed. In addition, access to the Cactus Hill Reservoir facility from the existing roadway network would require a permit from Weld County.

4.20.6 Mitigation

Impacts to traffic and transportation will be mitigated by the relocation of roadways that will be inundated. The relocations will be coordinated with and subject to approval from CDOT for U.S. 287

and Weld County for roads that would be inundated by Cactus Hill Reservoir.

4.21 LAND USE

Comments were received during scoping expressing concern regarding how the alternatives would affect land uses in the region. The trend in the region has been toward increased urbanization and reduced agricultural lands.

4.21.1 Methods

Existing land use data was gathered from local, state, and federal sources to characterize land ownership and land use patterns in the NISP study areas. This characterization included a review of land ownership maps and land management plans, personal conversations with city and town planners, and a review of information provided in county and community master plans. Land management policies and programs associated with regional government councils and planning commissions also were included in this review. The impact assessment focused on the probable changes to land use and land ownership that would result from implementation of the alternatives. The impact assessment also identified possible conflicts between the alternatives and federal, state, and local land use plans, policies, and regulations for the NISP study areas. Additional information on methods and sources is provided in the Land Use Technical Report (ERO 2008g).

4.21.2 Alternative 1—No Action

In general, the greatest potential for permanent changes to land use under the No Action alternative would be associated with the transfer of irrigation water from agricultural lands, which are estimated to

dry up to 69,200 acres of irrigated croplands that would be converted to dryland crop production or dryland grasslands (HDR 2007b).

4.21.3 Alternative 2—Proposed Action—Glade Reservoir and the SPWCP

4.21.3.1 Glade Reservoir

The District currently owns the majority of the land to be permanently affected (1,442.4 acres) at the proposed Glade Reservoir and does not allow public access.

4.21.3.1.1 Agriculture

A portion of the existing Munroe Canal used for irrigation passes through the proposed Glade Reservoir site and would be inundated. The Munroe Canal would require rerouting around the proposed Glade Reservoir to maintain the canal's functional use. This reroute is part of the Proposed Action and would travel under the proposed Glade Reservoir dam, through District, BLM, and private lands along the south and east sides of the proposed reservoir, and would connect to the existing Munroe Canal (Figure 2-2).

Weaver Ranch would lose several acres of ranch property to the proposed Glade Reservoir, although no structures would be affected.

4.21.3.1.2 Urban and Residential

Permanent impacts to private lands, other than District lands, would total 109.3 acres, including the Weaver Ranch property.

4.21.3.1.3 Transportation

The CSU access road to the Poudre River State Trust land would be partially inundated. The District has agreed to reroute the CSU access road.

A portion of U.S. 287 would be inundated by the proposed Glade Reservoir. As part of the proposed

realignment alternatives, the District would provide a 250-foot ROW for the U.S. 287 realignment and CDOT would abandon the 7.3-mile inundated portion of U.S. 287. The northern and western alignments would cross mostly private lands. The majority of these lands are owned by Holcim, Inc. and were used for limestone mining and a cement plant. The Holcim Mine completed the process of reclamation after 80 years of mining. Other smaller private land parcels adjacent to the proposed realignment alternatives are to the west and may have existing structures. The Weaver Ranch is located at the north end of each of the proposed realignments and would be dissected by either the northern or western alignment. The State Land Board owns a parcel through which the northern realignment would pass, which is currently used for grazing by the Weaver Ranch.

4.21.3.1.4 Utilities

Two towers on the Platte River Power Authority (PRPA) overhead 230 kV transmission line would have to be relocated to accommodate the proposed intersection and tie in to the existing U.S. 287. For the western alignment, a section of this line would have to be raised over or buried beneath the roadway fill section approaching the hogback cut. Along the northern alignment, the transmission line may have to be raised to accommodate the roadway alignment in the vicinity of the proposed Spring Creek crossing (Muller 2006b).

4.21.3.1.5 Other

The State Land Board owns the State Trust Land (340.1 permanently impacted acres) on the west side of the proposed Glade Reservoir. The State Land Board land is leased to CDOW for deer and small game hunting at specified times of the year, and is open for fishing year-round. Access to the State Trust Land is by foot or horseback only. The majority of this land is held in trust for CSU and the Poudre School District for educational purposes.

The BLM manages a 160-acre parcel that borders the east side of the proposed Glade Reservoir. Approximately 25.9 acres of this BLM parcel would be permanently impacted by the proposed Glade Reservoir. There is no public access to this parcel.

4.21.3.2 No Contract Subalternative

The proposed Glade to SWSP pipeline would come into contact with many types of land uses during construction such as residential, urban (west Fort Collins and west Loveland), agricultural, recreational, transportation, and utilities. Most of these land uses would be disrupted temporarily and would return to former uses upon completion of the pipeline.

4.21.3.3 Contract Subalternative

The proposed Glade Reservoir to Horsetooth pipeline would temporarily come into contact with various types of land uses during construction such as residential, agricultural, recreational, transportation, and utilities. The effects of pipeline construction would be temporary and most land uses would only be disrupted temporarily and would return to former uses upon completion of the pipeline.

4.21.4 Alternative 3—Cactus Hill Reservoir and the SPWCP

4.21.4.1 Cactus Hill Reservoir

Most of the Cactus Hill Reservoir site is owned by Anheuser-Busch and is not open for public use. It is used for disposal of wastewater associated with beer production. Other land uses and associated impacts are listed below.

4.21.4.1.1 Agriculture

Some areas of the Cactus Hill Reservoir study area are used for agricultural purposes such as crop

production and horse and cattle grazing. Portions of the Cactus Hill Reservoir site are enrolled in the CRP and are not in production. In addition, a small area of State Land Board land occurs in the northwest corner of the Cactus Hill Reservoir site. Overall, 158.2 acres of land would be temporarily affected and 4,384.5 acres of land would be permanently affected by construction of Cactus Hill Reservoir. Permanent effects consist of the dam, proposed roads, a pump station, the reservoir, and all associated facilities.

4.21.4.1.2 Urban and Residential

Eleven private residences would be inundated by Cactus Hill Reservoir and nine additional homes are within 1,000 feet of the proposed Cactus Hill Reservoir. Those residences within visual range of the proposed dam structure may experience a decrease in property values, while lakefront homes may experience an increase in property values.

4.21.4.1.3 Transportation

Cactus Hill Reservoir would inundate portions of WCR 15, 19, and 90; and WCR 15 is proposed to be realigned approximately 1 mile east of the existing alignment (Section 4.20.5).

4.21.4.1.4 Utilities

Power lines currently divide the Cactus Hill Reservoir site. These power lines would be rerouted around the west side of the proposed Cactus Hill Reservoir.

4.21.4.2 No Contract Subalternative

The proposed Cactus Hill to SWSP pipeline would come into contact with many types of land uses during construction such as rural and urban residential (north and west Fort Collins and west Loveland), agricultural, recreational, transportation, and utilities. Most of these land uses would be temporarily disrupted and would return to former uses upon completion of the pipeline.

4.21.4.3 Contract Subalternative

The proposed Cactus Hill to Horsetooth pipeline would temporarily come into contact with various types of land uses during construction such as rural and urban residential (north of Fort Collins), agricultural, recreational, transportation, and utilities. Most land uses would be disrupted temporarily and would return to former uses upon completion of the pipeline.

4.21.5 Alternative 4—Glade or Cactus Hill Reservoir and SPWCP and Agricultural Transfers

4.21.5.1 Glade Reservoir or Cactus Hill Reservoir

4.21.5.1.1 Agriculture

Effects to agriculture due to the construction of the proposed Glade or Cactus Hill reservoir would be the same as Alternative 2 or 3, plus the elimination of an estimated 17,137 acres of irrigated lands (discussed below).

4.21.5.1.2 Urban and Residential

The effects of Alternative 4 on urban and residential uses would be the same as Alternative 2 for the Glade Reservoir subalternative, and the same as Alternative 3 for the Cactus Hill Reservoir subalternative.

4.21.5.1.3 Transportation

The effects of Alternative 4 on transportation would be the same as Alternative 2 for the Glade Reservoir subalternative, and the same as Alternative 3 for the Cactus Hill Reservoir subalternative.

4.21.5.1.4 Utilities

The effects of Alternative 4 on utilities would be the same as Alternative 2 for the Glade Reservoir subalternative and the same as Alternative 3 for the Cactus Hill Reservoir subalternative.

4.21.5.2 Agricultural Transfer

About 17,137 acres of irrigated lands would be lost and 21,500 AF of agricultural water rights would be transferred into M&I use to provide 12,000 AF of yield. For the purpose of this analysis, it was assumed that the transfer would involve lands served by the Larimer-Weld and the New Cache canals (Figure 2-4). The total projected dry up under Alternative 4 would be about 4.4 percent of all irrigated lands in both Larimer and Weld counties (in 2002). Of the irrigated lands proposed for dry up, 15,695 acres are considered Prime Farmland (NRCS 2007).

No impacts to urban, residential, transportation, or utility land uses are anticipated due to the agricultural transfer portion of this alternative at this time.

4.21.5.3 No Contract Subalternative

The effects of the Reclamation No Contract Subalternative of this Alternative 4 would be the same as Alternative 2 or 3, depending upon which reservoir subalternative is chosen.

4.21.5.4 Contract Subalternative

The effects of the Reclamation Contract Subalternative of this Alternative 4 would be the same as Alternative 2.

4.21.6 Mitigation

Current land uses that would be disrupted or otherwise lost due to any of the alternatives would be mitigated for through the District's coordination with any entities (State Land Board, CSU, DOW, BLM, city or county governments, utility companies, or private parties) that would experience impacts due to the construction or operation of any components of the proposed project. Mitigation for

land use impacts are described in further detail in Chapter 5.

4.22 SOCIOECONOMIC RESOURCES

Comments were received during scoping regarding a variety of socioeconomic issues including effects to ratepayers in each of the Participant communities, effects to irrigators involved in water exchanges, and effects to regional population growth. An evaluation of disproportionate effects to minority or environmentally sensitive populations was also conducted.

4.22.1 Methods

Potential socioeconomic effects associated with the action alternatives were evaluated based on projected changes in economic and demographic measures including revenues, costs, income, and other variables associated with each of the potential issues (see Section 3.22.2). The Socioeconomic Resources Technical Report (HDR and BBC 2007) provides a detailed description of the methods and assumptions used to address the socioeconomic effects described herein.

Socioeconomic effects include benefits, or positive effects, resulting from the alternatives, as well as impacts, which are negative. Socioeconomic effects are described as “minor,” “moderate,” or “major” based on the following criteria. “Minor” is used when the benefits or impacts would be at low levels and may even go unnoticed by many people in the study area. “Moderate” is used when benefits or impacts would be noticeable by residents in the study area, but do not permanently disrupt current activities and lifestyles of residents and communities. “Major” is used when benefits or impacts would be substantial or highly noticeable by

residents and/or communities in the study area. The term “no impact” is used when there are no changes to existing conditions from the alternatives.

4.22.2 Impacts Common to Action Alternatives

4.22.2.1 Population Growth and Economic Growth

Population growth and economic growth are addressed in Section 4.2.1.7.3.

4.22.2.2 Community Impacts

All of the components of the action alternatives would be located outside of community boundaries. No community cohesion or quality of life impacts are associated with any of the action alternatives.

4.22.2.3 Environmental Justice

The action alternatives would not disproportionately impact any minority or environmentally sensitive populations during construction or operations. Impacts to water bills, affordability, and recreation are expected to occur equally to all citizens of participating communities.

4.22.2.4 Water Bills and Affordability

Water bills and affordability are addressed in Section 4.2.1.7.4.

4.22.2.5 Agricultural Impacts

Agricultural impacts associated with the SPWCP exchange are common to all action alternatives and are addressed in Section 4.2.1.7.2.

4.22.2.6 Recreational Value

Impacts to the value of recreation on the Poudre River common to all action alternatives are discussed in Section 4.2.1.7.1.

In addition to the impacts common to all action alternatives, there would be recreation value benefits associated with Glade Reservoir under Alternative 2. If managed in the future for public recreation, Glade Reservoir is expected to support water-based activities such as boating, windsurfing, swimming, fishing, and canoeing. New terrestrial recreation activities indirectly provided by Glade Reservoir could include camping, hiking, sightseeing, wildlife viewing, and biking. Total annual visitation at Glade Reservoir is estimated to be approximately 439,300. The annual recreation value benefit would be approximately \$17.1 million.

Boating recreational value would potentially be positively impacted by an extended season at the Filter Plant Run if the Munroe Canal diversion is used under Alternative 2 or 4 with Glade Reservoir. The Munroe Canal diversion point benefits kayakers on the Filter Plant Run by extending the boating season into August, and could increase the total recreation value for kayakers by one-third. Some outfitters believe it would also extend the rafting season, which could also increase the value of recreational rafting by one-third. It is not likely that the recreational experience would be changed for those kayakers and rafters using the Filter Plant Run. The potential benefit to recreational value of the Filter Plant Run could reach approximately \$165,600, if kayakers and rafters continue to use the run in August at the same average rate it is used in May through July – approximately 2,300 kayakers and rafters per month (HDR and BBC 2007). This is considered to be a moderate benefit to the recreational value of the Filter Plant Run.

No public access or future management for recreation is planned for the Cactus Hill Reservoir site under Alternative 3 or 4. Because no current recreation opportunities exist at the site, there would be no direct impacts to recreation value from the

construction or operation of the Cactus Hill Reservoir.

Impacts to recreation values for Alternative 4 would be similar to those documented for Alternative 2, if the Glade Reservoir is constructed, or Alternative 3 if Subalternative 4b (Cactus Hill) is constructed.

Galeton Reservoir is also a component common to all action alternatives. Because the area for Galeton Reservoir is currently privately held land, it is unknown how many visitor days are used for recreation activities (hunting and wildlife viewing) and how the landowner's use or allowance of others use on the land for recreation would change after the construction of Galeton Reservoir. No public access, recreation opportunities, or recreation-related facilities are planned at the Galeton Reservoir; therefore, no visitation increases are expected from the construction of Galeton Reservoir.

The Mitani-Tokuyasu SWA is approximately 67.3 acres, and the Galeton forebay is expected to inundate approximately 21 acres. Impacts to visitation would depend upon the design of the forebay and replacement of the parking area and a portion of the access road that would be lost with construction of the forebay.

4.22.2.7 Construction-related Economic Impacts

During the construction period, expenditures to develop facilities under any of the alternatives would provide a short-term stimulus to the construction industry along Colorado's Front Range. The action alternatives would likely support several hundred direct construction jobs during the first phase of development, and a smaller number of jobs during the second phase of development. The No Action alternative, which has lower construction costs, would support somewhat fewer construction jobs.

None of the action alternatives would bring new money into the region. It is anticipated that the costs of NISP would be 100 percent locally financed by the Participants. Higher water bills and connection charges would reduce the amount of money that local residents and businesses have to spend on other goods and services in the region. Overall, the economic stimulus during the construction period would likely be offset by comparatively smaller reductions in other regional economic activity over a more extended period of time.

4.22.3 Summary Comparison of Impacts by Alternative

Table 4-14 summarizes the socioeconomic impacts associated with the alternatives. Because the exact projects associated with the No Action alternative are not known, several potential impacts of that alternative also are not known.

4.22.4 Mitigation

Increases in salinity of irrigation water, which could affect crop yields, would be mitigated for all action alternatives by the District by compensating irrigators as part of the agreement of the irrigator to participate in the exchanges. Mitigation for water-based recreation is described in Chapter 5.

4.23 HAZARDOUS SITES

The disruption of known hazardous materials by construction or location of facilities near hazardous materials sites was an issue expressed by the public during scoping.

4.23.1 Methods

Known hazardous materials sites within the study areas have been reviewed using existing data based on known hazardous materials sites (Section 3.23).

4.23.2 Effects

The action alternatives are not expected to contribute to or aggravate any hazardous material sites. The proposed realignment of U.S. 287 has been designed to avoid the Holcim Mine cement kiln dust landfill. The proposed Glade Reservoir forebay is located near the Atlas “E” Missile Site 13 and a known TCE plume associated with the missile site. The TCE plume is discussed in Section 3.23.3.1.

4.23.3 Mitigation

The proposed realignment of U.S. 287 has been designed to avoid the Holcim cement kiln dust landfill. Measures to avoid and minimize the effects of the TCE plume include an impermeable lining along the walls and bottom of the Glade forebay, testing of ground water encountered during construction, and following Colorado Hazardous Waste Regulations as described in greater detail in Chapter 5.

4.24 NOISE

Increased noise associated with construction would occur in localized areas temporarily during construction and traffic noise associated with a realigned U.S. 287. Construction and traffic noise was identified in scoping as potential issues to be evaluated.

Table 4-14. Summary of Socioeconomic Impacts for All Alternatives.

Socioeconomic Issues	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Cactus Hill	Subalternative 4.1 Cactus Hill/ Ag. Transfers	Subalternative 4.2 Glade Res./ Ag. Transfers
Population/economic growth	No impact; no change in regional growth pressure				
Community impacts	Minor impact	No impact			
Environmental justice	No impact; no disproportionate effects on minority/low income groups				
Incremental increase in Participant customer water bills (2020 over 2006 conditions)	\$206/year \$26/month	\$138/year \$12/month	\$147/year \$12/month	\$184/year \$15/month	\$191/year \$16/month
Affordability of water bills	Minor impact ¹	No impact ¹			
Agricultural impacts from water quality	No impact	Minor impact; loss of production less than 0.1 percent			
Agricultural impacts from water transfers	Moderate impact	No impact	No impact	Minor impact; loss of production of about 3.3 percent of total agriculture output	
Recreational value	Potential minor benefits from gravel pits	Offsetting impacts ²	Moderate adverse impact to Poudre River recreation	Same as Alternative 2	Same as Alternative 3
Impacts from U.S. 287 relocation	No impact	Minor impact	No impact	Minor impact	Minor impact
Construction-related economic impacts	No impact	Minor impact			
Cumulative impact issues	Accelerated conversion of agricultural lands	Recreation effects due to reduced Poudre River flows			Recreation effects due to reduced Poudre River flows Accelerated conversion of ag. lands but less than No Action

¹Affordability varies by Participant. In general, Participants that currently have affordable rates are projected to remain affordable.

²Potential high beneficial effect to recreation from Glade Reservoir and moderate adverse impact to Poudre River recreation.

4.24.1 Methods

Estimates of short-term increases in noise levels associated with construction were based on the types of construction equipment used and the location of facilities. Noise levels associated with the realignment of U.S. 287 were modeled using projected 2030 traffic levels and representative receptor locations within 500 feet of the centerline of the alignments (MERC0 2006a).

4.24.2 Effects Common to All Alternatives

All of the alternatives would have short-term increases in noise levels associated with construction. All of the action alternatives should have similar levels of construction-related noise because the types of construction equipment and construction schedules are similar. Most

construction activities would occur in undeveloped areas and would be affected by new sources of noise more than urbanized areas. The equipment used to construct the facilities (e.g., loaders, backhoes, scrapers, heavy trucks, generators, air compressors, and concrete mixers) generally operate in the range of 70 to 90 dBA. These noise levels are estimated at 50 feet from the source. The noise levels diminish rapidly at greater distances. On-site construction noise may periodically exceed the EPA noise threshold of 70 dBA for public exposure, but the public would not be exposed to these levels on a continuous basis. The construction-related noise levels for the alternatives are not expected to exceed relevant standards or guidelines.

4.24.3 Alternative 2—Proposed Action—Glade Reservoir and the SPWCP

In addition to the facilities construction activities discussed for all of the alternatives, Alternative 2 would require the realignment of U.S. 287. Noise levels for the construction of U.S. 287 would be similar to the construction-related noise levels discussed in the previous section.

Glade Reservoir may be managed for public recreation. Recreational activities and associated traffic would increase the current noise level at the Glade Reservoir site. These increases are expected to be minor.

4.24.4 U.S. 287 Realignment

The U.S. 287 realignment alternatives occur within a currently undeveloped reclaimed quarry and rural open terrain. There are no residences within 500 feet of the centerline of the alternative alignments. Modeled noise levels, using projected 2030 traffic levels, from representative receptor locations within

500 feet of the centerline of the alignments ranged from 53.9 dBA to 63.3 dBA for the western alignment and 53.9 dBA to 66.9 dBA for the northern alignment. One modeled receptor location among the 35 modeled locations was above the Noise Abatement Criteria Category B 66 dBA Approach Criteria. This location occurs at the north end of the northern alignment where the alignment would rejoin existing U.S. 287. There are no residences near this location. No residences along either alignment would experience noise levels above the Approach Criteria, even using projected 2030 traffic volumes (MERC0 2006a).

4.24.5 Mitigation

Mitigation for noise is not proposed. The construction-related noise levels are not expected to exceed relevant standards or guidelines. No residences along either alignment would experience noise levels above the Approach Criteria.

4.25 AIR QUALITY

Air quality was not raised as an issue during scoping, but the Corps needs to address compliance with air quality standards.

4.25.1 Methods

Short-term changes in air quality associated with construction were based on the type of construction and equipment that would be used. Motor vehicle emissions associated with travel on a realigned U.S. 287 were evaluated based on existing air quality information for the region and the location of sensitive receptors relative to the proposed realignments (MERC0 2006b).

4.25.2 Effects Common to All Alternatives

All of the alternatives would cause short-term increased exhaust emissions associated with construction vehicles (employee, delivery, and heavy-duty equipment). Construction would also create fugitive dust. All of the action alternatives should have similar levels of emissions because the types of construction equipment and construction schedules would be similar. Construction-related effects associated with the No Action alternative, as well as the associated emissions, would be more dispersed geographically. Construction would cause short-term increases of particulate matter (PM₁₀) and gaseous pollutants (NO_x, CO, SO_x, and VOCs) near construction areas. These emissions are expected to be within the conformity levels.

4.25.3 Alternative 2 and Subalternative 4.1

In addition to the activities discussed for all of the alternatives, Alternative 2 and Subalternative 4.1 would require the realignment of U.S. 287, which would lengthen the overall construction schedule in the Glade Reservoir-U.S. 287 realignment area. The longer construction schedule would lead to an increased period of construction-related emissions relative to the other action alternatives.

4.25.4 U.S. 287 Realignment

Motor vehicle emissions in the study area would not result in an exceedance of the NAAQS (MERCO 2006b). The amount of mobile source air toxics emitted would be proportional to vehicle miles traveled. Currently there are no sensitive receptors (e.g., homes and schools) close to the realignment alternatives. Future emissions levels would likely be lower than existing levels as a result of EPA's

national control programs that are projected to reduce mobile source air toxic emissions by 57 to 87 percent by 2020. Construction activities would temporarily increase particulates (PM₁₀).

4.25.5 Mitigation

To minimize and control fugitive dust, the District will develop and implement a fugitive particulate emission control plan that specifies steps that will be taken to minimize fugitive dust generation.

4.26 ENERGY USE

All of the action alternatives would rely on electrical energy to power pumps to pump water up to reservoirs or for the SPWCP to deliver water to canals for exchange. Estimated annual power consumption is shown in Table 4-15.

4.27 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

The construction or operation of the Proposed Action would involve irreversible and irretrievable commitments of various resources that are either consumed, committed, or lost during the life of the project (Section 4.1.2.3). The irreversible and irretrievable commitment of resources of the Proposed Action include:

- **Geology**—Loss of material from borrow areas within the reservoir basins, hogbacks, and the rock cut if the western U.S. 287 realignment alternative is constructed. Construction of new reservoirs such as Chimney Hollow or Dry Creek within the NISP cumulative effects study area, and increased residential, commercial, and infrastructure development, in combination with NISP, would further reduce accessibility to

Table 4-15. Power Consumption Estimates.

Pump Station	Avg. Annual Pumped (AF)	Pump Head (feet)	Annual KwHrs	Total
Glade Pump Station ¹	44,800	240	13,760,000	
Munroe Booster ²	N/A	N/A	500,000	
South Platte Pump Station	32,600	400	16,690,000	
Larimer and Weld	14,800	160	3,030,000	
Glade to Carter Pipeline ³	29,500	640	24,000,000	57,980,000
Glade to Horsetooth Pipeline ^{3, 4}	2,600	200	500,000	33,980,000

¹Glade Pump Station assumes all water pumped into Glade Reservoir. This could be reduced by half through exchange and diverting at the Munroe Canal.

²Munroe Booster Station would be co-located with the Glade Pump Station.

³The Glade to Horsetooth pipeline is mutually exclusive from the Glade to Carter pipeline.

⁴The Glade to Horsetooth pipeline would require pumping when the elevation in Glade Reservoir is below that of Horsetooth Reservoir.

geologic resources. Additional reservoirs, when combined with NISP, would alter sedimentation and sediment transport in the Poudre and South Platte rivers.

- Soils—Loss of soil, including Prime Farmland soils, due to reservoir inundation and highway construction.
- Construction Materials—Use of aggregate, steel, concrete, and fossil fuels for facilities construction.
- Water—The reservoirs would inundate intermittent and ephemeral drainages, the increased surface area of the reservoirs would increase evaporation, and the diversion and consumptive use of the water would reduce flows and the availability of water for resources and other uses in the Poudre and South Platte rivers.
- Cultural Resources—Construction may cause the incidental impact to cultural resources, nonrenewable resources that could be lost.
- Paleontological Resources—Construction of U.S. 287, particularly the road cut associated with the western realignment alternative, may cause the incidental impact to paleontological resources, nonrenewable resources that could be lost.

- Vegetation, Wildlife Habitat, and Wetlands—Irretrievable vegetation, wildlife habitat, and wetlands would be lost as a result of construction of the dams, reservoirs, forebays, and realignment of U.S. 287. Construction of the pipelines and other temporary disturbances would be a temporary irretrievable loss of vegetation, wildlife habitat, and wetlands.
- Visual—Short-term and long-term changes would occur to the visual quality of the reservoir areas and U.S. 287 realignment alternative.

With the exception of the realignment of U.S. 287, all of the action alternatives would have similar irreversible and irretrievable commitments of resources. Additionally, the No Action alternative and Alternative 4 would have substantially increased impacts on Prime Farmland soils and irrigated crops associated with the transfer of irrigation water to M&I use.

4.28 CUMULATIVE EFFECTS

The following section describes the actions that are reasonably foreseeable and not reasonably foreseeable for the analyses of cumulative effects in

association with NISP. Table 4-21 summarizes the cumulative effects for all alternatives by resource and issue. More details on cumulative effects can be found in the Cumulative Effects Technical Report (ERO 2008f) and the Water Resources Technical Report (HDR 2007b).

4.28.1 Reasonably Foreseeable Actions Not Part of the Proposed Action or Alternatives

Under NEPA, federal agencies are required to assess the cumulative effects of their actions, defined as the impact on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such action (40 CFR 1508.7).

This section of the EIS describes the process for identifying reasonably foreseeable actions, as well as those actions that were not considered reasonably foreseeable or that would not have any overlapping impacts with NISP.

4.28.1.1 Identifying Reasonably Foreseeable Actions

Potential future actions were identified through public and agency scoping, input from cooperating agencies and local agencies, and available data on known projects or actions under consideration. Actions that meet all of the following criteria were considered reasonably foreseeable and were included in the cumulative effects analysis:

- The action would occur within the same geographic area where effects from the alternative NISP actions are expected to occur (the cumulative effects study area is shown in Figure 4-5, and includes the

District boundaries, outside of which, impacts from NISP are not expected to occur).

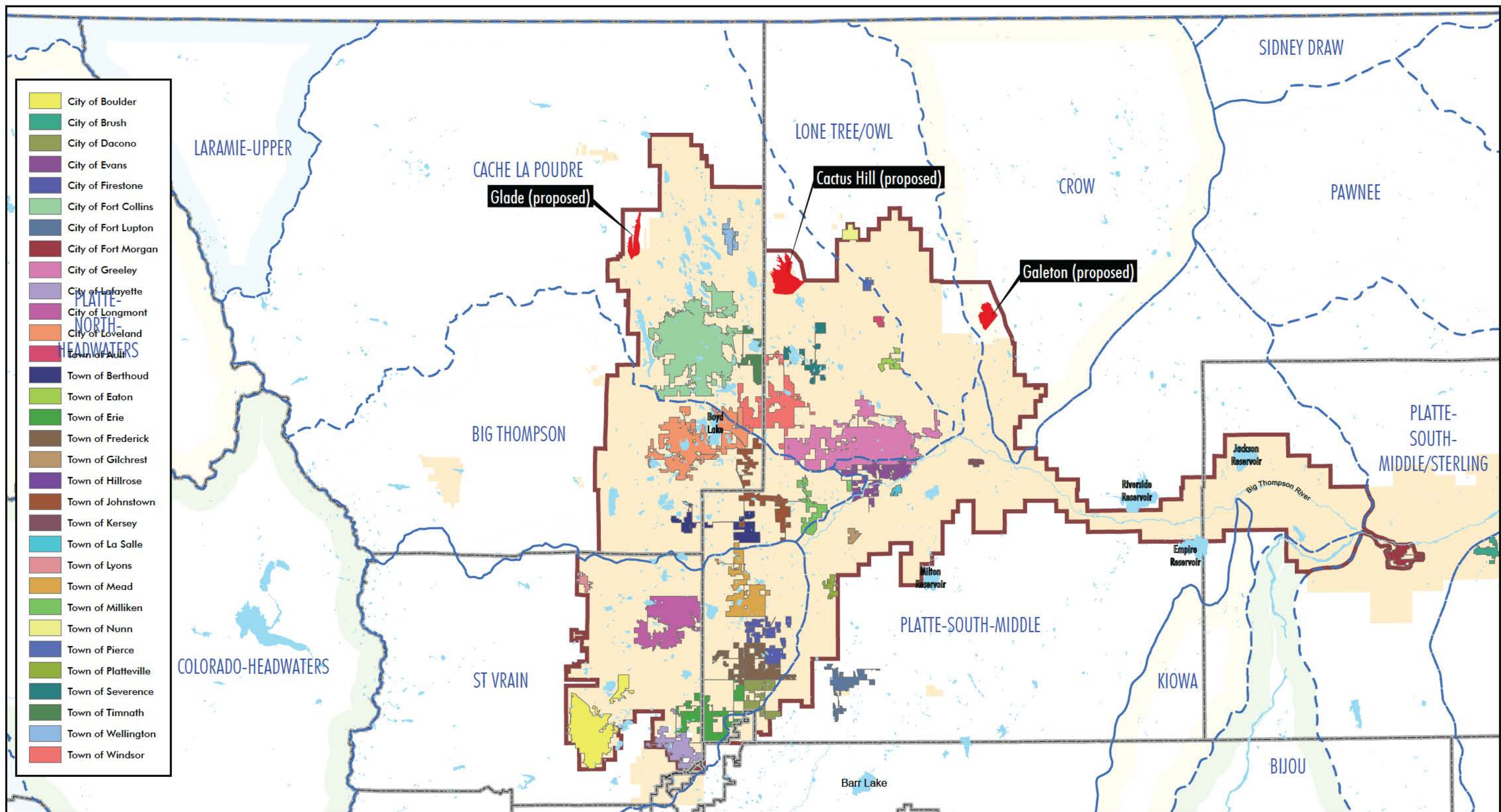
- The action would affect the same environmental resources as NISP alternatives, and measurably contribute to the total resource impact.
- There is reasonable certainty as to the likelihood of the future action occurring; the future action is not speculative.
- There is sufficient information available to define the future action and conduct a meaningful analysis.

4.28.2 Reasonably Foreseeable Actions

Impacts associated with NISP would occur from two primary types of actions, one from surface disturbance associated with construction of reservoirs and associated facilities, and one from the diversion of water from the Poudre River and South Platte River. Reasonably foreseeable actions were classified as either water-based or land-based actions that might have effects overlapping those of the NISP. Those future actions that meet the criteria for being reasonably foreseeable are described below.

4.28.2.1 Water-Based Actions

The operations of NISP combined with the operations of the following reasonably foreseeable water projects in the region will be evaluated for potential cumulative effects. Water-based actions are actions that would involve construction, expansion, or re-operation of existing reservoirs or water delivery ditches, canals, pipelines and other facilities, diversions to or from streams, reuse of water, water rights acquisition and transfer, and construction of water and wastewater treatment facilities.



Northern Integrated Supply Project EIS

- Proposed Reservoirs
- Drainage Basins
- County Boundary
- Cumulative Impacts Study Area
- Northern Colorado Water Conservancy District

Prepared by:
ERO

Figure 4-5
NISP Cumulative Impact Study Area

Prepared for: U.S. Army Corps of Engineers
File: 2701-Cumulative_effects_11x17_Growth.mxd (JP)
September 13, 2007

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Halligan and Seaman Water Management Projects. The City of Fort Collins and its partners, as well as the City of Greeley propose to enlarge the storage capacity of the existing Halligan Reservoir to approximately 40,000 AF and Milton Seaman Reservoir to 53,000 AF. Both are located on the North Fork of the Poudre River. The reservoir expansions are proposed to provide drought protection for current and future water demands in their service areas. The proposed HSWMPs will provide additional storage on the North Fork of the Poudre River.

When combined with NISP, this project will affect Poudre River flows. Based on the currently available information for the HSWMPs, it is not possible to accurately determine the effects to Poudre River flows associated with the transfer and/or exchange of irrigation water from existing ditch headgates to the new proposed HSWMPs storage facilities. As a result of the transfer of an estimated 36,000 AF of agricultural water, it is likely that there will be substantial changes in flow on the Poudre River between the points of diversion for the HSWMPs and the current points of diversion.

Flows in the reach of the Poudre River between the Poudre Valley Canal headgate and the Larimer-Weld Canal headgate in Fort Collins would be affected by the combined diversions and exchanges of NISP and HSWMPs. The Poudre Valley Canal headgate is the primary diversion point for NISP and the Larimer-Weld Canal headgate downstream is assumed to be the farthest downstream point for HSWMPs agricultural transfers. Below the Larimer-Weld Canal headgate, there would not be a cumulative flow reduction by NISP and HSWMPs unless HSWMPs would also involve new water rights on the Poudre River or agricultural transfers downstream of the Larimer-Weld Canal headgate. Figure 4-6 shows the annual average hydrograph of the combined effects of NISP and HSWMPs.

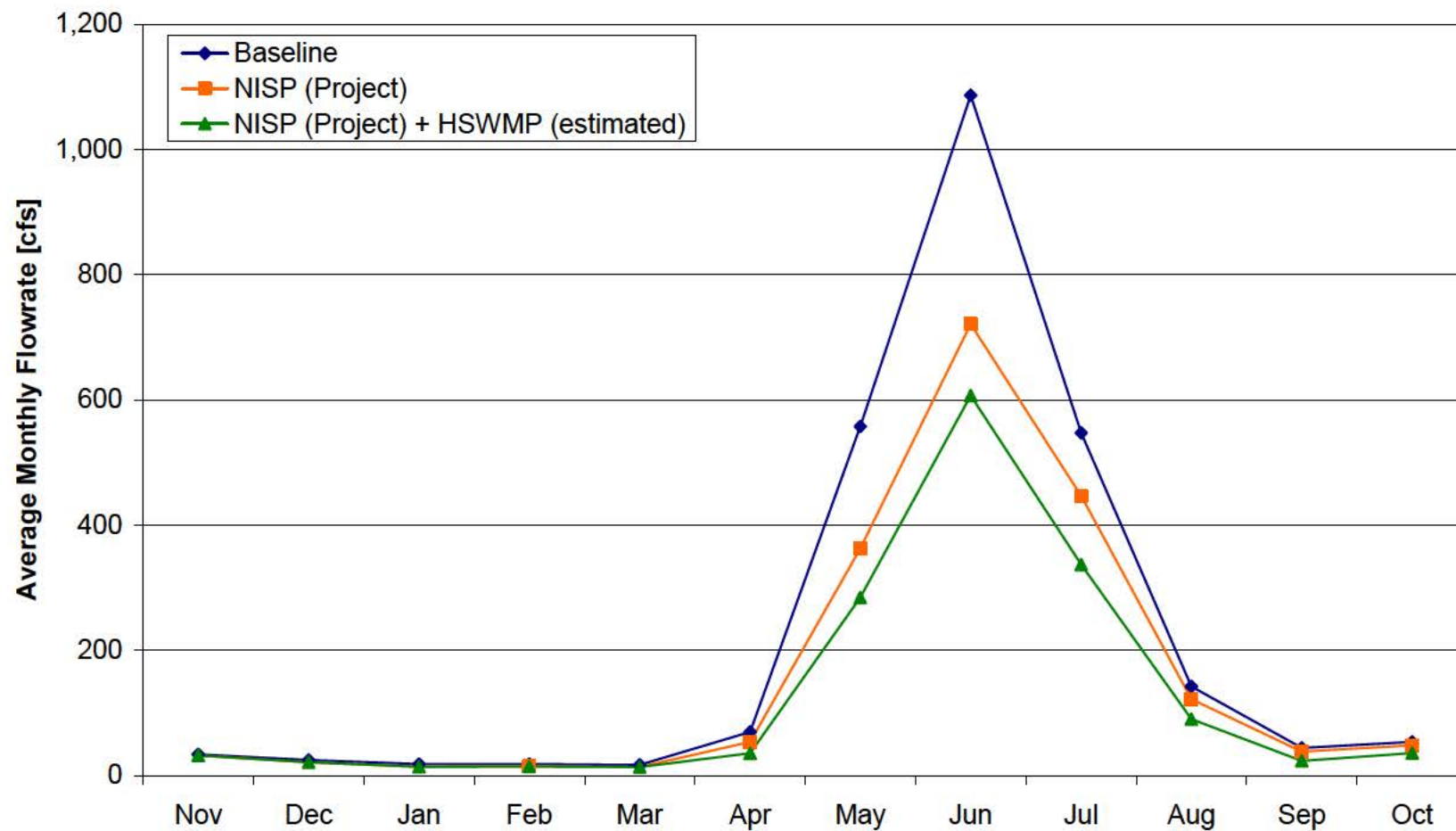
FCLWD is a participant in NISP and also is a participant in the proposed HSWMPs as part of the Tri-Districts. The HSWMPs and NISP are separate projects with independent utility. FCLWD has requested 3,000 AF of firm yield in the proposed project. Including the firm yield requested from NISP, FCLWD will still have a projected firm yield deficit of 4,800 AF in 2050 (Table 1-11). Assuming a conservative storage-to-yield ratio of 2 to 1, the requested storage in the proposed HSWMPs when combined with the yield from NISP would not meet the projected 2050 firm yield deficit for FCLWD.

Both the Halligan and Seaman Reservoir sites were eliminated during the alternatives screening for NISP because of impacts to perennial drainages (HDR 2007a).

Windy Gap Firming Project. The Municipal Subdistrict of the Northern Colorado Water Conservancy District (Subdistrict), on behalf of several of the Windy Gap Project unitholders or allottees and the Middle Park Water Conservancy District, is currently pursuing the WGFP. The WGFP is designed to deliver a firm yield from the existing Windy Gap Project and its associated water rights on the Colorado River.

Some of the NISP Participants are also participating in the proposed WGFP (CWCWD, Town of Erie, City of Evans, City of Fort Lupton, and the City of Lafayette). NISP and the WGFP are separate projects with independent utility (see Chapter 1). If the WGFP is built as proposed, it would provide a firm water supply to the five common participants of about 2,400 AF depending on Participant storage requests and the alternatives under evaluation. This additional future firm water supply would not be enough to replace or reduce the combined respective requested firm annual supply from NISP.

Figure 4-6. Average Annual Hydrograph, Average Monthly Flow Rates, MODSIM Link MAIN6, Poudre River between New Mercer and Larimer No. 2 Headgates (Upstream from Larimer-Weld Canal Headgate), IY 1950–1999.



Dry Creek Reservoir Project. The CWCWD and the Little Thompson Water District have recently constructed an 8,800 AF reservoir on about 300 acres of land about 4 miles east of Carter Lake. This reservoir is used to store a portion of both districts' C-BT water to improve daily operational flexibility and drought protection.

Moffat Collection System Project. Denver Water is proposing to provide an additional 18,000 AF of firm yield from its Moffat Treatment Plant to address additional treated water demands. Additional storage is proposed totaling approximately 72,000 AF, a portion of which may affect South Platte River flows. NISP and the Moffat project are separate actions having independent utility. The proposed additional storage in the South Platte River Basin, when combined with NISP, will affect South Platte River flows.

Chatfield Reallocation. The Colorado Water Conservation Board (CWCB), on behalf of a number of water users and in-stream water interests has developed a plan to reallocate the use of water in Chatfield Reservoir, located in Douglas and Jefferson counties southwest of Denver, to store municipal and industrial water supplies. Chatfield Reservoir currently is operated as a flood storage reservoir. Because of concerns about increasing demands for water and difficulties in finding new water storage sites, the Corps is investigating the feasibility of reallocating water uses in Chatfield Reservoir, and is developing an EIS to address these issues. The reallocation of storage in Chatfield Reservoir could affect flows in the South Platte River.

City of Denver Reuse Project. The City of Denver diverts Colorado River Basin water to the South Platte River Basin through the Roberts and/or Moffat tunnels. Under Colorado law, water that is imported from another basin can be reused to

extinction. The City of Denver plans to fully reuse its Colorado River Basin water. Increased reuse of the transbasin water will affect South Platte River flows. The combination of NISP, and reuse by Denver and Aurora (see below), are estimated to reduce South Platte River flows as modeled at the Kersey gage by an estimated 2.4 million AF over the course of the 50-year modeled period (HDR 2007b).

City of Aurora Prairie Waters Project. The City of Aurora owns and diverts water from the Colorado and Arkansas River basins to the South Platte River Basin. The City of Aurora is building the Prairie Waters Project, which would enable the City to reuse its Colorado and Arkansas River Basin water. Increased reuse of this transbasin water will affect South Platte River flows.

City of Fort Collins Water Craft Course. The City of Fort Collins plans to enhance water-based recreation on the Poudre River through Fort Collins. A water craft course is planned near College Avenue. Currently, the features of the course will be designed to function at flows as low as 150 cubic feet per second (cfs). Average monthly flows at the Lincoln Avenue gage are currently within the 150 cfs designed minimum flow level of the proposed College Avenue water craft course in May, June, and July in most years. Existing average monthly flows in dry years in May and July are less than the 150 cfs minimum design flow.

Greeley and Colorado Division of Wildlife New Fishing Access. Greeley and CDOW were awarded a grant through the Fishing is Fun program for the development of a new fishing access on a pond along the Poudre River in Greeley. The project is pending Service approval.

Augmentation of Lower South Platte River Wells. Many tributary ground water wells with junior water rights on the lower South Platte River in Colorado are being required by the State Engineer's Office to

develop augmentation plans to offset the consumptive use of the wells and protect senior water rights. The augmentation plans typically involve the diversion and storage of water from the South Platte River when the relatively junior water rights are in priority (high flows and during the winter) and/or the purchasing or leasing of transbasin return flows. These augmentation plans will affect South Platte River flows.

Greeley Bellvue Pipeline. The City of Greeley is in the process of building a 30-mile, 60-inch finished water transmission pipeline that will carry water from its Bellvue Filter Plant located northwest of the City of Fort Collins to Greeley's drinking water distribution system. The new pipeline will provide additional transmission capacity to the City of Greeley's existing system. Greeley is constructing the project in phases and has completed approximately 15 miles of the new pipeline. The water transmitted by the 60-inch pipeline may include some water stocks that Greeley has historically treated at the Bellvue Filter Plant, as well as anticipated new supplies. These water sources include Cache la Poudre River water stored in a planned reservoir expansion, transmountain water from the Laramie and Colorado rivers, and water from the north fork of the Poudre River. Some of these sources will require future water rights change cases.

Termination of Municipal/Domestic Leaseback of C-BT Water to Agriculture. The Colorado-Big Thompson (C-BT) Project was originally developed for the purpose to supply supplemental water to irrigators in northern Colorado. Over time, municipalities and other domestic water providers have acquired significant quantities of C-BT units. As of 2003, ownership of C-BT units split approximately 60 percent M&I, and 40 percent agricultural (Gibbens 2006). However, actual deliveries of water were the opposite percentages

due to rental and leaseback programs operated by municipalities with surplus water supplies. The current trends of shifting ownership and deliveries are expected to continue in the near future.

In the Poudre Basin MODSIM network used for the hydrologic analyses for the EIS, 2003 levels of C-BT ownership were applied over the full 50-year simulation period. In a few cases, ownership and usage are not the same.

At the present time, the municipalities do not necessarily have demands for all the C-BT water they own. Therefore, the model represents leaseback (rental) of surplus water by Fort Collins and Greeley. In the model simulations, Fort Collins rents an average of 3,516 AF per year, and Greeley rents an average of 2,388 AF per year. This rental water is delivered back in varying percentages to C-BT accounts for New Cache, NPIC, and Larimer-Weld canals. While this attempt has been made to capture some of the rental programs in the Poudre Basin MODSIM network, it is likely that there are greater volumes of rental water not represented. As municipal demands for water grow, the quantity of C-BT water leased back to irrigators is likely to diminish.

Future reduction or termination of existing leaseback/rental programs (e.g., Fort Collins and Greeley leaseback of C-BT water to NPIC, Larimer-Weld, and New Cache canals) as municipal domestic demands increase may result in lower flows below the Hansen Canal outlet. Potential cumulative effects include reduction of the exchange capacity available to facilitate NISP deliveries under the Reclamation Contract Subalternative. If the average annual exchange capacity drops below 29,500 AF from reduced C-BT releases to the Poudre River through the Hansen Canal, it may be necessary to construct the Glade to Horsetooth pipeline to

maintain NISP deliveries to the southern Participants.

Modified Diversion Patterns above the Mouth of the Poudre Canyon. Results of post-NISP simulations suggest potential changes in Poudre River flow patterns in reaches above the proposed NISP diversion at the Poudre Valley Canal headgate. The specific causes of the changes and the true likelihood of occurrence are unclear; one possible explanation is a shift in the timing of certain diversions due to the water rights being in priority at different times. The simulated flow changes in the upper Poudre Basin are generally small on a flow rate (cfs) and percentage basis when averaged over the 50-year study period.

Cache la Poudre Flood Reduction and Ecosystem Restoration Project. The Corps is evaluating the feasibility of flood reduction and ecosystem restoration measures within a 17-mile reach of the Cache la Poudre River, in and around Greeley. Flood damage reduction efforts will be directed at a roughly 7-mile reach of the river (Birch Avenue, upstream to North 47th Avenue) inside the city limits, and will focus on protecting high-damage areas along a 2- to 3-mile reach largely east of 11th Avenue. The ecosystem restoration effort will include areas of the entire 17-mile reach with focus on the restoration of old oxbows and meander channels, available gravel pits and floodplain storage areas, and providing connectivity through green space restoration in the flood way. The gravel pits that characterize much of the floodplain in and around Greeley will be evaluated for both their flood storage utility and their potential to improve the ecosystem of the river and its floodplain (Corps 2006). Because the project currently does not propose effects to river flows, there are no anticipated cumulative effects with NISP to Poudre or South Platte river flows.

Climatic Change and Global Warming. Climate change and global warming may affect NISP and other water users in the South Platte River Basin. Climate changes may affect precipitation, Poudre and South Platte river streamflows, and the amount of water available for diversion by NISP. Temperature records and climatic modeling indicates higher temperatures, which can result in earlier snowmelt and runoff, higher evaporation rates, and increased water demands (National Research Council 2007).

Unlike the Colorado River Basin, climate change studies and model development have yet to be undertaken for the Poudre or South Platte river basin. For the Colorado River Basin, climatic models have predicted warming, reduced snowpack, earlier snowmelt runoff, and seasonal streamflow changes (NRC 2007). Differences in model predictions for the Colorado River basin from different climate change models demonstrate the uncertainty in estimating future conditions.

A reduction in precipitation and streamflow would reduce the amount of water available for diversion by NISP, while conversely, an increase in precipitation could increase the frequency and amount of diversions; however, the yield for NISP is capped at an average of 40,000 AF per year. Reductions in Poudre and South Platte river streamflows would generally reduce the amount of water available to the more junior water right holders in the basin, including NISP. Although climatic change is considered reasonably foreseeable, there is no accepted science for transforming the general concept of variations in global temperature into incremental changes in streamflow at particular locations. Hydrologic changes attributable to global climate change are a possibility; however, potential impacts have not been quantitatively estimated in the EIS because of

the uncertainties associated with predicting change and the effects.

4.28.2.2 Land-Based Actions

Land-based actions are actions that would involve construction of residential, commercial, and industrial structures, construction and expansion of city, county, state, and federal roads and highways, construction of reservoirs and pipelines (these may be considered in the context of water based and land based actions, and they likely involve both types of impacts), placement of utility lines and pipelines, oil and gas development, mining, and other infrastructure such as railroads and airports.

Reservoir Construction and Expansion. The construction of Chimney Hollow and Dry Creek reservoirs and the expansion of Halligan and Seaman reservoirs are considered land-based actions as well as water-based actions, because they would affect the lands on which they are constructed.

Population Growth in the Northern Front Range. Continued population growth and urban development is expected to occur in the northern Front Range Colorado communities served by the Participants regardless of the proposed NISP or its alternatives.

Land Development. A variety of new land developments are expected to occur in the vicinity of the potential NISP reservoir sites in Larimer and Weld counties. In September 2005, Holcim (U.S.), Inc. auctioned approximately 3,080 acres of property located mostly east of the proposed realignment alternative for U.S. 287. Most of the auctioned property includes 35-acre or greater parcels for residential development. The plat approved by Larimer County includes about 60 residential parcels, some of which occur near the proposed realignment for U.S. 287.

North I-25 Transportation Improvements. CDOT is evaluating multi-modal transportation improvements along about 70 miles of the I-25 corridor between Fort Collins and Denver. The EIS is evaluating transportation options such as inter-regional bus service, combination general purpose/high occupancy vehicle lanes, and passenger rail service (CDOT 2007). The North I-25 EIS is in the Draft EIS phase and CDOT is studying the environmental effects of the alternative design packages.

Commercial and Residential Development along the Poudre River in Fort Collins. The City of Fort Collins has begun construction of a new Northside Aztlan Community Center, which is designed to be twice the size of the existing community center. This construction is taking place near the Gustav Swanson Natural Area, downtown and along the Poudre River. The facility will have a recreation center, community meeting rooms, an aerobic facility, outdoor fields for sports, and a skate park. This facility is expected to have an annual capacity of 500,000 visitors. The Penny Flats Loft Development project will construct eight buildings that will house 147 residential units with 30,000 square feet of commercial space beginning in February 2007 along the Poudre River in north Fort Collins. The Willow Street Lofts is a new development along the Poudre River north of downtown Fort Collins. This development will house 20 residential units and 10,000 square feet of commercial space. New commercial development is under construction along the Poudre River at the corner of Riverside and Lemay streets.

Timnath Poudre Trail Connections. Timnath has platted two segments of the Poudre River trail. Both segments are located a short distance from the Poudre River, but will eventually link the Windsor and Fort Collins portions of the trail.

4.28.3 Actions Not Considered Reasonably Foreseeable

A summary of potential actions considered and the reasons why they are not reasonably foreseeable is discussed below. Although these actions are not currently considered reasonably foreseeable, they could occur at some point in the future; however, based on the best available information, these actions did not meet the criteria for reasonably foreseeable actions.

4.28.3.1 Water-Based Activities

Water Rights Acquisition and Transfer. It is probable that water rights acquisition and transfers will continue in the future on the Front Range and throughout Colorado. Water rights transfers from agricultural to municipal and industrial uses in the South Platte River and the Cache la Poudre River watersheds are likely. The transfers and timing of the transfers that would take place are impossible to predict, as they would take place in the free market. It is likely that water would be transferred from C-BT and non-CBT agricultural sources to M&I uses. This is not considered reasonably foreseeable because it is difficult to predict with any certainty what transactions may occur in the future. Assumptions on the potential actions and effects in combination with NISP are speculative.

Wastewater Treatment Facilities. To respond to population trends, it is likely that additional wastewater treatment facilities will be constructed to serve various municipalities in the NISP cumulative effects study area. This is not considered reasonably foreseeable because it cannot be predicted with any certainty what treatment facilities will likely be constructed in the future. Assumptions on the potential actions and effects in combination with NISP are speculative.

Water Treatment Facilities. As water is transferred from agricultural to M&I uses, the need for municipal water treatment will grow. Additional water treatment facilities likely will be constructed in the NISP cumulative effects study area to accommodate this increase in municipal water use. This is not considered reasonably foreseeable because it cannot be predicted with any certainty what treatment facilities will likely be constructed in the future. Assumptions on the potential actions and effects in combination with NISP are speculative.

Green River Pipeline Project. The Green River Pipeline Project, as currently proposed by the Million Conservation Resource Group, would divert water from the Green River in Colorado below Flaming Gorge Reservoir, and deliver the water to Colorado's Front Range through pipelines running through Colorado and Wyoming. This 400-mile long pipeline project is considered speculative because it is very early in the planning process and the NEPA process has not begun. The project would involve a legal filing and appropriation of the water in the State of Colorado, which likely would not occur in a timely manner.

Yampa River Project. The Yampa River project is proposed by the NCWCD. It would involve diversion of water from the Yampa River near Maybell, Colorado and would deliver water to the northern Front Range of Colorado via a pipeline. This project is considered speculative because it is in the preliminary planning stages, and likely would face years of planning, environmental permitting, water rights acquisitions, and local, state, and federal authorizations.

Union Creek Reservoir. To improve the City's water storage capacity, the City of Longmont has investigated the potential for enlargement of Union Creek Reservoir in Boulder County. The City of Longmont has no immediate plan for enlargement of

Union Creek Reservoir for at least 15 years and at that time would evaluate the need. The potential reservoir sizing and operations are not known and would be speculative to consider for the cumulative effects analysis.

Other Reuse Projects. Other reuse projects likely will be proposed in the future. Increasingly, developments are planned with dual use systems, which enable a city to use nonpotable water for outdoor irrigation, and potable water for indoor use. Other kinds of reuse likely will be planned in the future. The location, timing, and size of the future reuse projects are not known and would be speculative to consider for the cumulative effects analysis.

4.28.3.2 Land-Based Activities

Decrease in Acres of Agricultural Farmland. In Larimer, Boulder, Weld, and Morgan counties (the counties in which the NISP Participants are located), the area of agricultural farmland has decreased in the past 20 years, and likely will continue to decrease due to commercial and residential development and the transfer of irrigation water to M&I uses. The timing and location of the decreases in farmland cannot be accurately determined and would be speculative to consider for the cumulative effects analysis.

Ongoing Gravel Mining. It is likely that gravel mining will continue in northeastern Colorado, and that many gravel mines will be converted to water storage lakes following mining. It is not possible to accurately predict the specific location of gravel mines because the timing and location of the mining are subject to market forces.

4.29 U.S. 287—SUMMARY OF ENVIRONMENTAL CONSEQUENCES

The following is a description of the effects associated with the proposed realignment alternatives for U.S. 287 associated with Alternative 2 and Subalternative 4.1. These effects were previously described in this chapter under each resource and the methods can be found in each of these previous resource sections.

4.29.1 Geology

4.29.1.1 U.S. 287 Western Realignment Rock Cut

The U.S. 287 western realignment alternative associated with Alternative 2 involves a cut through a linear rock ridge trending approximately north-south with sedimentary rock striking with the ridge and dipping to the east between 12 and 25 degrees. The eastern exposure of the cut is sandstone of the Lytle Formation, which is estimated to be a maximum of 80 feet thick and a minimum of approximately 50 feet, with a weighted average of approximately 60 feet. Underlying the Lytle Formation and exposed on the west side of the ridge is the Morrison Formation. The interface between the Lytle and Morrison Formations was assumed to dip at 14 degrees to the east. The Morrison Formation is characterized primarily by claystone with some sandstone layers.

Rock excavation and cut slopes would be required as the alignment traverses west through the existing ridge west of the Holcim property. The proposed road cut is planned to penetrate the ridge completely and would be approximately 2,000 feet long, a maximum of 220 feet deep, and a maximum width of 880 feet. The side slopes are estimated to be between 2H:1V and 1H:1V, depending on the

location and ground type. These inclinations are required for slope stability. Some rock reinforcement may also be required. It is expected that rockfall would be addressed with a combination of rock reinforcement, rockfall screen, and catchment ditches. Excavation of the rock cuts is expected to require a combination of blasting and ripping. Preliminary design of the cut is for the side slopes to be 1H:1V in the Lytle Sandstone and 2H:1V in the Morrison Formation. The specific design of these cut slopes would be developed during final design.

4.29.1.2 Mitigation

If the western alignment is selected, the District will coordinate with CDOT regarding the rock cut. The District will conduct a slope stability, landslide evaluation and rockfall study for the hogback cut area. The District will consider measures to mitigate icing and blowing snow conditions at the rock cut. The District will also implement measures to mitigate the visual effects of the rock cut (Chapter 5).

4.29.2 Paleontology

Direct impacts on paleontological resources primarily relate to the potential destruction of paleontological resources and the loss of information associated with those resources. If potentially fossiliferous bedrock or surficial sediments are disturbed, project excavations may result in the destruction of paleontological resources and the subsequent loss of information (adverse impact). However, construction impacts also result in the exposure of fossils that may never have been unearthed by natural means. If mitigation measures are implemented, these newly exposed fossils would become available for salvage, data recovery, scientific analysis, and preservation into perpetuity

at a public museum (beneficial impact). Direct adverse impacts can typically be mitigated to below a level of significance through the implementation of a paleontological monitoring and mitigation program (Section 5.6).

In general, for projects containing paleontologically sensitive geologic units such as the Morrison Formation, the greater the degree of construction-related ground disturbance, the higher the potential for adverse impacts on paleontological resources. Potential adverse impacts on paleontological resources include direct (construction-related) impacts, indirect (operations-related) impacts, and cumulative impacts created by the potential long-term loss of the resources to society.

4.29.2.1 Direct Impacts

The potential for direct adverse impacts on scientifically significant subsurface fossils known to exist in fossiliferous sedimentary deposits is controlled by two factors: 1) the depth and lateral extent of the disturbance of fossiliferous bedrock and/or surficial sediments; and 2) the depth and lateral extent of the occurrence of fossiliferous bedrock and/or surficial sediments beneath the surface. Where the depth of disturbance exceeds the depth of occurrence, potential direct adverse impacts may occur due to breakage and crushing of fossils during ground disturbance associated with construction.

Due to the topography of the area, it is expected that large amounts of rock would need to be excavated for the construction of the western alternative, particularly in the vicinity of the Dakota hogback. Within the APE for the western alignment, potential direct adverse impacts on paleontological resources are most likely to occur where bedrock strata of *Class 3* and *Class 5* geologic units are disturbed by construction (Table 3-34). Construction excavations

have the potential to adversely impact an unknown quantity of fossils, which may occur on or below the surface in areas containing paleontologically sensitive geologic units. Without mitigation, these fossils, as well as the paleontological data they could provide if properly salvaged and documented, could be adversely impacted (destroyed), rendering them permanently unavailable for future scientific investigation.

4.29.2.2 Indirect Impacts

Indirect impacts are those resulting from the post-construction normal operations of transportation infrastructure within the APE for the alternatives. No indirect impacts on paleontological resources would be expected to occur from the continuing operation of the highway realignment or any associated facilities.

4.29.2.3 Mitigation

Prior to construction of the U.S. 287 realignment, the District and the Corps will coordinate with the CDOT staff paleontologist to examine the final design plans and determine the extent of bedrock impact and the scope of paleontological monitoring required. Before the construction permit is issued by CDOT, a qualified and permitted paleontologist (Project Paleontologist) will be retained by the District to produce a project-specific mitigation plan. The Project Paleontologist and District will be responsible for implementing the mitigation measures in coordination with CDOT. This includes supervising the monitoring of construction excavations in areas with paleontological sensitivity. The details of what the mitigation plan will address and how it will be implemented are presented in Chapter 5.

4.29.3 Soils

The realignment of U.S. 287 would cause increased soil erosion, and the paved surfaces would permanently cover soils and remove them from productivity. The longer northern alignment would have a greater effect on soils. With the control of erosion, the effects on soils associated with construction of the alignments should be moderate.

4.29.3.1 Mitigation

The District will coordinate with CDOT to develop and implement a stormwater management plan for the construction of a U.S. 287 alignment. The plan will address measures to avoid and minimize soil erosion. Mitigative measures are discussed in Sections 5.8.4 and 5.9.1.

4.29.4 Vegetation

The U.S. 287 realignment alternatives were evaluated for impacts to vegetation. Direct effects to vegetation resources were assessed quantitatively using GIS to overlay the roadway alignments on maps of vegetation cover types. Permanent effects to vegetation resources would occur in areas that are permanently altered by road construction. Temporary effects to vegetation resources would occur in areas that would be returned to their approximate original contour and revegetated following construction, such as embankments, shoulders, and staging areas. Methods for evaluating impacts to vegetation are described in the Vegetation Resources Technical Report (ERO 2008a).

4.29.4.1 Direct Effects to Vegetation in the U.S. 287 Study Area

The western and northern alignments travel through the Holcim Mine, which is composed of disturbed and reclaimed areas. Under both alternatives, about

20 acres of disturbed and about 42 acres of reclaimed areas would be permanently impacted by placement of the road. About 70 to 80 acres of reclaimed areas would be temporarily impacted (see Table 4-16). Disturbed and revegetated areas are of lower quality than native vegetation types because of disturbances that have occurred in the past. Also, disturbed areas along roads are major vectors for noxious weed dispersal. The permanent impacts to vegetation that would occur under both U.S. 287 realignment alternatives are considered moderate long-term effects.

4.29.4.2 Avoidance and Minimization

Riparian areas were identified as a sensitive vegetation type to try to avoid. Avoidance of all riparian areas was not possible because of the limited amount of land available for the realignment project. The U.S. 287 realignment has been designed to avoid impacts to riparian areas to the greatest extent practicable. The preliminary design for the western alignment was to maximize the distance the alignment would travel in the Holcim Mine area, rather than disturbing areas that had not been previously disturbed. The western alignment is also the shortest route from the Holcim Mine to existing U.S. 287, and minimizes riparian impacts. In preliminary design, the northern alignment involved greater impacts to riparian vegetation in the Owl Canyon area. The alignment was further refined in an effort to minimize those impacts.

4.29.4.3 Mitigation

Proposed mitigation measures would include the immediate restoration of temporarily disturbed wetland, riparian, and upland areas. All native trees removed as part of construction of the U.S. 287 realignment would be replaced with native trees such as peachleaf willow, plains cottonwood, and ponderosa pine. The location and number of trees to

be planted would be detailed in the final construction plans. Mitigation measures will also include a noxious weed control plan following state and local requirements and guidelines (see Chapter 5).

BMPs such as silt fencing would be established and maintained to minimize sediment from reaching wetlands and riparian areas that would not be filled. The fencing would also serve to delineate the limits of project disturbance.

4.29.5 Wetlands and Other Waters

The U.S. 287 realignment alternatives were evaluated for impacts to wetlands and other waters. Permanent effects to wetlands and other waters would occur in areas that would be permanently altered by road construction. Temporary effects to wetlands and other waters would occur in areas that would be returned to their approximate original contour and revegetated following construction, such as embankments, shoulders, and staging areas.

4.29.5.1 Direct Effects to Wetlands in the U.S. 287 Study Area

About 2.5 acres of mostly low quality wetlands for the western alignment of the proposed U.S. 287 realignment would be permanently impacted (Table 4-17). The northern alignment would permanently impact 0.8 acre of wetlands, with most of the impacts occurring along the moderate quality wetlands in Owl Canyon.

A function and value assessment was conducted for the wetlands in the U.S. 287 realignment study area. Almost all of the wetlands that would be affected under the western or northern realignment are palustrine persistent emergent wetlands. The U.S. 287 realignment study area contains both riverine and depressional wetlands. The riverine wetlands in the U.S. 287 realignment study area generally are rated moderate to high for general wildlife habitat,

sediment/nutrient/toxicant removal, production export/food chain support, and sediment/shoreline stabilization. The depressional wetlands in the U.S. 287 study area are rated moderate to high for general wildlife habitat, sediment/nutrient/toxicant removal, production export/food chain support, and ground water discharge/recharge.

4.29.5.2 Avoidance and Minimization

The preliminary design of the U.S. 287 realignment involved revisions to avoid and minimize impacts to wetlands and other waters. Unavoidable impacts to

wetlands and other waters may be further minimized during the design process.

Impacts to the existing wetlands and other jurisdictional waters of the U.S. would be avoided and minimized to the greatest extent possible during final design and construction of the project by using BMPs.

4.29.5.3 Mitigation

4.29.5.3.1 Restoration of Temporary Impacts

All temporary impacts to wetlands from road building would be restored in place by:

Table 4-16. U.S. 287 Realignment Vegetation Effects.

Vegetation Types	U.S. 287 Western		U.S. 287 Northern	
	Perm (ac.)	Temp (ac.)	Perm (ac.)	Temp(ac.)
Upland native grasslands	45	31	60	89
Upland mixed grasslands	5	5	6	4
Upland introduced grasslands	0	0	0	0
Mesic native grasslands	2	< 1	1	1
Mesic mixed grasslands	3	4	6	3
Upland native shrublands	23	12	26	43
Mesic native shrublands	0	0	0	0
Mesic mixed shrublands	0	0	0	0
Upland native woodlands	0	0	0	0
Mesic mixed woodlands	1	< 1	1	1
Agricultural lands	0	0	2	1
Revegetated areas	44	67	42	81
Disturbed areas	17	3	21	3
Landscaped areas	0	0	0	0
Roads	1	1	0	0
Palustrine persistent emergent wetlands	2	< 1	< 1	<1
Palustrine scrub-shrub wetlands	< 1	<1	1	1
Other waters (ponds and lakes)	< 1	0	< 1	< 1
Other waters (creeks and streams)	< 1	< 1	<1	1
Other waters (ditches and canals)	< 1	< 1	< 1	< 1
Total¹	143	123	166	228

¹Potential error due to rounding +1/-1 (ac).

Table 4-17. Effects to Wetlands and Other Waters for the U.S. 287 Realignment.

Wetlands and Other Waters	U.S. 287 Western Realignment		U.S. 287 Northern Realignment	
	Perm. (ac.) ¹	Temp. (ac.) ²	Perm. (ac.)	Temp. (ac.)
Palustrine persistent emergent wetlands (PEW)	2.3	0.2	0.1	0.1
Palustrine scrub-shrub wetlands (PSSW)	0.2	0	0.7	0.5
Total Wetlands	2.5	0.2	0.8	0.6
Other waters (ponds and lakes) (OW-P)	0.2	0	0.1	0.1
Other waters (creeks and streams) (OW-C)	0.4	0.1	0.5	0.6
Other waters (ditches and canals) (OW-D)	0.2	0.1	0.1	0.2
Total Other Waters	0.8	0.2	0.7	0.9
Total Wetlands and Other Waters	3.3	0.4	1.5	1.5

¹Permanent effects include areas within the proposed road and cut, and fill slopes.

²Temporary effects include construction impacts.

- Salvaging and replacing wetland topsoils.
- Regrading wetland sites to preconstruction elevations and contours.
- Revegetating disturbed areas with appropriate native seeds and plantings.

All temporary impacts to open waters would be restored by returning the sites to pre-construction contours.

Compensatory Mitigation

The U.S. 287 realignment would permanently impact 2.5 acres for the western alignment and 0.8 acre for the northern alignment. Compensatory mitigation to replace these wetlands would be constructed along an intermittent stream in an area south (downgradient) of the Poudre Valley Canal (ERO 2008b). The mitigation site would be graded to the elevation of the existing wetlands. Water from the adjacent intermittent stream and, if necessary, the Poudre Valley Canal would support these wetlands. The wetland mitigation areas would be planted and/or seeded with native wetland vegetation appropriate to this area.

4.29.6 Riparian Resources

Impacts to riparian resources would be minor. The western and northern alignment alternatives would each permanently impact about 1 acre of riparian vegetation types (mesic native shrubland, mesic mixed shrubland, mesic mixed woodland), and temporarily impact less than 1 acre of riparian vegetation types.

4.29.6.1 Mitigation

These minor impacts would be mitigated by reestablishing riparian vegetation.

4.29.7 Wildlife

The western and northern alignments would have a common alignment through the recently reclaimed Holcim Mine. Between 37 and 58 percent of the surface impacts from the realignment of U.S. 287 occur in either disturbed or reclaimed areas. About 55 acres of grasslands and about 23 acres of shrublands would be permanently lost as a result of the western realignment. The northern realignment

would have greater impacts on these habitat types and their associated bird species, and would result in permanent impacts to about 73 acres of grasslands and about 26 acres of shrublands.

For both realignment alternatives, only small amounts of combined riparian, wetland, and aquatic habitat would be impacted. The western alignment would result in the loss of 4 acres and the northern alignment would result in the loss of 2 acres of these combined habitats. Temporary impacts to wetland, riparian, and aquatic habitat would occur to less than 1 acre for the western realignment and less than 3 acres for the northern realignment. Impacts to wildlife and their habitats would be similar for both of the realignment alternatives.

4.29.7.1 Mitigation

Impacts to wildlife habitat would be mitigated by revegetating areas temporarily disturbed by construction and replacing lost riparian and wetland habitats.

4.29.8 Species of Concern

Two prairie dog colonies occur on the west side of the U.S. 287 realignment study area. The northern end of the U.S. 287 realignment study area is designated as swift fox overall range (CNDIS 2006), although home ranges are limited by the existing U.S. 287. Habitat for the common gartersnake and northern leopard frog occurs along wetlands and drainages in the U.S. 287 realignment study area, and tadpoles identified as probable northern leopard frog tadpoles were observed in wetlands and open waters on the west side of the Holcim Mine. During field surveys, Bell's twinpod was found at the Holcim Mine and surrounding area. The largest populations occur on the undisturbed shale ridges, east of the Holcim Mine with scattered individuals to moderately dense populations found within the

Holcim Mine. Direct impacts of the U.S. 287 realignment alternatives on species of concern are shown in Table 4-18.

4.29.8.1 Mitigation

Mitigative measures for species of concern are described in Table 4-12.

4.29.9 Recreation Resources

Section 4(f) (49 U.S.C. 303) of the Federal Highway Administration DOT regulations states that the construction of a federal highway utilizing federal funding should not result in a restriction in access that substantially diminishes the utility of a publicly owned park or recreation area. The relocation of U.S. 287 under either subalternative (northern or western alignment) would not utilize any federal funding and, therefore, Section 4(f) would not apply.

4.29.10 Cultural Resources

Section 4(f) (49 U.S.C. 303) of the Federal Highway Administration DOT regulations states that the construction of a federal highway utilizing federal funding should not result in a restriction in access that substantially diminishes the utility of a publicly owned park, recreation area, or a historic site. The relocation of U.S. 287 under either subalternative (northern or western alignment) would not utilize any federal funding and, therefore, Section 4(f) would not apply.

Direct effects would occur to three previously recorded cultural resources. Two of these sites (5LR9649 and 5LR9930) have been determined eligible and would require mitigation (Table 3-29). One site has been recommended not eligible and requires a DOE from SHPO; and assuming concurrence from SHPO, no further evaluation would be required. Nine known but unrecorded

Table 4-18. Direct Impacts (acres of habitat) of the U.S. 287 Western and Northern Alignments on Species of Concern.

Habitat Type	U.S. 287 Western		U.S. 287 Northern	
	Perm. (ac.) ¹	Temp. (ac.) ²	Perm. (ac.) ¹	Temp. (ac.) ²
Preble's occupied habitat	0.0	0.0	0.0	0.0
Bald eagle nest buffer	0.0	0.0	0.0	0.0
Bald eagle winter concentration area	0.0	0.0	0.0	0.0
Prairie dog colony	3	<1	1	2
Swift fox overall habitat	0	0	0	0
Bell's twinpod locations - all densities	27	43	22 ³	42 ³
Wetlands and riparian ^{4,6} (common gartersnake and northern leopard frog habitat)	4	<1	2	1
Aquatic habitat ^{5,6} (northern leopard frog habitat)	1	<1	1	1

¹Permanent effects include realigned roads.

²Temporary effects include construction impacts for realigned roads and other facilities, access roads, and borrow areas.

³Only the portions of the northern alignment overlapping the western alignment were surveyed; therefore, for the northern alternative, impacts are likely to be greater than shown in this table.

⁴Riparian and wetland habitat includes mesic mixed shrubland, mesic native shrubland, mesic mixed woodland, and palustrine persistent emergent and palustrine scrub-shrub wetlands vegetation communities as described in ERO 2008a.

⁵Aquatic habitat includes lakes, ponds, creeks, streams, ditches, and canals as described in ERO 2008b.

⁶Due to rounding, impact acreages may differ slightly from those shown in ERO 2008a.

cultural resources would also be potentially affected by either abandonment of the current alignment or construction of either of the two proposed realignments. Although an eligibility assessment requires documentation and concurrence from SHPO, it is likely that at least four potentially eligible cultural resources (WCRM 2007) would be adversely affected by realignment of U.S. 287 (36 CFR 800.5), and would require mitigation as a resolution of adverse effects (36 CFR 800.6). Effect determinations and mitigation resolution will be determined following formal cultural resource documentation or reevaluation, agency review, and consultation with SHPO.

4.29.10.1 Mitigation

Mitigation would occur based on the requirements of the Programmatic Agreement (Appendix C) and is summarized in Section 5.5.1.

4.29.11 Aesthetics and Visual Resources

The realignment alternatives would have a different landscape and visual setting than the segment of U.S. 287 that would be inundated by Glade Reservoir.

The pavement type and width, ditch configurations, shoulders, and striping for both alternatives would be the same. Therefore, the roadway facilities of both alternatives would have the same visual characteristics.

The southern 5 miles of both alignment alternatives are the same. Both are located in the Holcim Mine. This portion of the alignment alternatives is an extremely disturbed landscape due to past surface mining for the extraction of limestone. Although the

Holcim Mine site has been revegetated, the landforms created during mining operations are in significant contrast with adjacent undisturbed landforms. Revegetation is composed of herbaceous plants with a contrasting color and texture to the adjacent undisturbed plant communities. Therefore, neither alignment alternative within the Holcim Mine site would create noticeable contrasts.

Vehicles traveling on the western or northern realignment alternative would be noticeable from all visibility areas in the northern, eastern, and southern portions of the study areas. Vehicles traveling on the realignment alternatives also would introduce visible light (from headlights) at nighttime. The presence of vehicles on the realignment alternatives would reduce the scenic quality of portions of the study areas.

Relative to the section of U.S. 287 that would be replaced, the scenic quality would also be reduced for travelers on the alternatives through the Holcim Mine site due to: landform, color, and texture contrasts with adjacent landscapes; the absence of mountain views to the west; the absence of variety in rock forms; and the presence of artificial forms to the east such as numerous residences and town/city and utility developments (ERO and HLA 2008).

4.29.11.1 U.S. 287 Western Realignment

This alternative would be the shortest length of new road (7.9 miles), but would create a cut through the hogback formations between the Holcim Mine and U.S. 287. The highway cut would create a significant contrast in most scenic quality elements. The continuity of the existing hogback formation would be interrupted, causing a noticeable change in landform. The cut also would introduce the artificial form of the roadway facility and contrasts in rock form, color, and texture. The cut would be visible

from most of the study areas and many locations west of the hogback.

North of the Holcim Mine and east of the hogback formation, this alternative would cross a high plains prairie landscape. Although the road facility would introduce an artificial form to this portion of the study area, multiple large power transmission lines and dirt roads exist in this vicinity. Additionally, the alternative would have relatively small cuts and/or fills due to the nearly flat topography of the prairie.

Scenic quality would be significantly reduced by the western alignment alternative due to the visible contrasting changes in landform, rock form, color, and texture. Visibility of the contrasts would extend beyond the study area predominantly to the west and would affect travelers on the highway.

4.29.11.2 U.S. 287 Northern Realignment

This alternative would be the longest length of new road (12.8 miles), and would avoid any disturbance to the hogback formation. North of the Holcim Mine, and east of the hogback formation, this alternative would cross a high plains prairie landscape. Although the road facility would introduce an artificial form to this portion of the study area, multiple large power transmission lines, many fences, and dirt roads exist in this vicinity. Additionally, the alternative would have relatively small cuts and/or fills due to the nearly flat topography of the prairie. Because very few OPs exist in the northern portion of the study area, the potential negative visual effects from vehicle headlights, and the presence of vehicles during daytime, would be seen by few, if any, viewers.

Scenic quality would remain unchanged in some locations and would be reduced in most locations. Unchanged scenic quality locations would be in the northernmost portion of the study area due to the presence of views of the mountains to the west.

Reduced scenic quality locations would be in and near the Holcim Mine. This portion of the study area includes many existing artificial forms; substantial contrasts in landforms, color, and texture; and almost complete obscurity of mountain views to the west. However, visibility of the alternative is largely limited to the study area.

4.29.11.3 *Visual Quality Effects Common to Both Alternatives During Construction*

The short-term and temporary impacts on scenic quality common to both alternatives during construction would be the generation of dust, the presence of construction equipment, potential construction nighttime lighting, and areas of vegetation clearing. Dust would be emitted from earthmoving activities, construction vehicles, and equipment; and from areas within the construction zone that have been disturbed or where excavated material is stockpiled. This “fugitive” dust could temporarily distract from, or partially obscure, existing views.

4.29.11.4 *Mitigation*

Short-term effects to visual resources will be reduced by controlling fugitive dust. The District will coordinate with CDOT to minimize adverse visual effects of the relocation of U.S. 287 on the road cuts, rock cuts, fills, and retaining walls. These mitigation measures are presented in detail in Chapter 5.

4.29.12 Noise

The U.S. 287 realignment alternatives occur within a currently undeveloped reclaimed quarry and rural open terrain. No residences are within 500 feet of the centerline of the alternative alignments. Modeled noise levels, using projected 2030 traffic levels, from representative receptor locations within

500 feet of the centerline of the alignments ranged from 53.9 dBA to 63.3 dBA for the western alignment and 53.9 dBA to 66.9 dBA for the northern alignment (MERC0 2006a). One modeled receptor location among the 35 modeled locations was above the Noise Abatement Criteria Category B 66 dBA Approach Criteria. This location occurs at the northern end of the northern alignment where the alignment would rejoin existing U.S. 287. There are no residences near this location. No residences along either alignment would experience noise levels above the Approach Criteria, even using projected 2030 traffic volumes.

4.29.12.1 *Mitigation*

No residences along either alignment are estimated to experience noise levels above the Approach Criteria and no mitigation is proposed.

4.29.13 Air Quality

Motor vehicle emissions in the study area would not result in any exceedance of the NAAQS (MERC0 2006b). The amount of mobile source air toxics emitted would be proportional to vehicle miles traveled. Currently there are no sensitive receptors (e.g., homes and schools) close to the realignment alternatives. Emissions in the future would likely be lower than present levels as a result of EPA’s national control programs that are projected to reduce mobile source air toxic emissions by 57 to 87 percent by 2020. Construction activities would temporarily increase particulates (PM₁₀).

4.29.13.1 *Mitigation*

In order to minimize and control fugitive dust, the District will develop and implement a fugitive particulate emission control plan that identifies specific steps that will be taken to minimize fugitive dust generation.

4.29.14 Traffic and Transportation

Construction of the Glade Reservoir and dam would inundate a portion of the existing U.S. 287 between Ted's Place and Owl Canyon Road. As a result, a portion of the highway between Owl Canyon Road on the north and Overland trail on the south would be realigned to maintain this connectivity. Assuming that the speed limit does not change, the difference in travel times should not change by more than a few minutes. Other traffic-related impacts associated with the realignment include:

- Existing traffic patterns are not expected to change; therefore, reduced traffic volumes are anticipated along the section of SH 14 where the two highways would no longer run concurrently (between Overland trail and Ted's Place).
- The existing U.S. 287/SH 14 intersection (at Ted's Place) is under stop control for the west leg (SH 14) of the intersection. It is expected that this traffic control will be sufficient for the realignment.
- The Bonner Spring Ranch Road would be affected by the realignment and the placement of Glade Reservoir. Alternative access would be provided.
- Big Ridge Way would be affected by the realignment and the placement of Glade Reservoir. Alternative access would be provided.
- Access to a CSU/State Land Board parcel west of Glade Reservoir would be affected. Alternative access would be provided.
- Traffic volumes along U.S. 287 could increase if public recreational activities are developed for Glade Reservoir.

The traffic volume generated to/from the Laporte area that will use the U.S. 287 north of Laporte is approximately 400 vpd (Muller 2007). Conservatively assuming that all of this traffic is concentrated on a few local roadways and ultimately

utilizes Overland Trail Road exclusively, the increase in peak hour volume is assumed to be approximately 50 vehicles per hour for both directions. Assuming that half of these vehicles are traveling northbound, this would increase the northbound left turn onto U.S. 287 from Overland Trail Road by 25 vehicles in the peak hour. This potential addition of 25 left-turning vehicles (and coincident southbound right turns) are not anticipated to significantly alter the operation of this intersection or any local roadway or street in Laporte.

It is anticipated that the Glade Reservoir and dam would not significantly impact traffic volumes on the existing roadway network. If public recreational activities are provided at this site, then minor seasonal fluctuations in vehicle volume can be anticipated. Adequate access roads and parking would need to be provided to accommodate the public.

The realignment of U.S. 287 would not change the highway designations or the access control for either U.S. 287 or SH 14. The final design of the realignment would meet all CDOT and Larimer County requirements (Chapter 5).

4.29.14.1 Mitigation

The District has committed to work with CDOT on the relocation of U.S. 287 if the Proposed Action is permitted. A traffic study and traffic control plan for construction will be developed for the Larimer County location and extant review and CDOT design of the U.S. 287 realignment. Chapter 5 specifies the issues and standards the District will follow for final design, property acquisition, coordination with utilities, relocation of impacted facilities, design of the rock cut for the western alignment, and mitigation of ice and snow conditions at the rock cut.

4.29.15 Land Use

The District would provide an alternative 250-foot-wide ROW for the U.S. 287 realignment and CDOT would abandon the 7.3-mile portion of U.S. 287 that would be inundated by Glade Reservoir. The northern and western alignments cross mostly private lands (Table 4-19). The majority of these lands are owned by Holcim, Inc. and were used for limestone mining and a cement plant. Other smaller private land parcels adjacent to the proposed realignment alternatives are to the west and have existing structures. The Weaver Ranch is located at the north end of each of the proposed realignments and would be dissected by either the northern or western alignment. The State Land Board owns a parcel through which the northern realignment would pass.

4.29.15.1 Mitigation

Mitigation for impacts to current land uses would be accomplished through the District's cooperation and coordination with all affected entities (CDOT, Holcim, Weaver Ranch, and any other private landowners).

4.29.16 Socioeconomic Resources

A number of privately owned properties are located along the hogback between the proposed Glade Reservoir site and the old limestone haul road. North of the former haul road, the proposed

realignments would pass through at least one privately owned ranch property. Realignment of U.S. 287 would likely improve access to these nearby properties, but also would affect their current remote character. The majority of past studies have found that improved accessibility increases the value of properties near newly constructed highways (Ryan 1999).

Very few businesses would be affected by the proposed relocation, with the exception of a gasoline station/convenience store and a campground located at Ted's Place, at the current intersection of U.S. 287 and SH 14. Current ADT volumes indicate that about two-thirds of the traffic passing these businesses is traveling along U.S. 287, while about one-third is traveling along SH 14. The proposed relocation of U.S. 287 would move the U.S. 287/SH 14 interchange approximately 3 miles to the east and U.S. 287 traffic would no longer directly pass these businesses. If the customer traffic for these businesses is proportionate to the relative traffic volumes on U.S. 287 and SH 14, and their business consequently declines by as much as two-thirds with the relocation of U.S. 287, the businesses may no longer be viable. Both businesses might, however, experience some offsetting positive benefits from recreational visitors to the proposed Glade Reservoir.

Relocation of U.S. 287 is not expected to cause any other community impacts or environmental justice issues. The area impacted by the relocation of U.S.

Table 4-19. Land Ownership Acreages for U.S. 287 Realignment Alternatives.

Ownership	Permanent Impacts	Temporary Impacts
State Land Board/Western Alignment	0	0
District/Western Alignment	0.17	0.09
Private/Western Alignment	144.30	122.87
State Land Board/Northern Alignment	2.32	5.67
District/Northern Alignment	0	0.02
Private/Northern Alignment	162.54	222.52

287 is rural in nature and outside of community boundaries. There is little community cohesion here. The population within the impact area for U.S. 287 relocation does not have a disproportionately higher population of minorities or other environmentally sensitive populations than the Participant communities and the State of Colorado.

4.29.16.1 Mitigation

The socioeconomic impacts associated with the U.S. 287 realignment are minor and no mitigation measures are proposed. Landowners affected by ROW acquisition will be fairly compensated.

4.29.17 Hazardous Sites

The realignment alternatives have a common alignment through the reclaimed Holcim Mine. The realignment has been designed to avoid the Holcim Mine cement kiln dust landfill, the only known hazardous materials site in the study area.

4.29.17.1 Mitigation

No mitigation is proposed because the realignments have been designed to avoid the cement kiln dust landfill, the only known hazardous materials site in the U.S. 287 study area.

Table 4-20. Summary of Estimated Effects for the Alternatives.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
1.	Surface Water	Flow reductions in reaches impacted by agricultural transfers scattered throughout Poudre River, Big Thompson River, St. Vrain Creek, Boulder Creek, and South Platte River basins in the vicinity of No Action Participant groups or individual water providers.	Reduced Poudre River peak flows below Poudre Valley Canal headgate primarily during May and June peak runoff period. Reduced flows between PVC and Larimer-Weld and New Cache headgates due to direct flow and storage exchanges during irrigation season (April-October). Reduced South Platte River flows below SPWCP diversion point (near Kersey gage).		Somewhat higher NISP diversions (and, thus, flow reductions) than Alternative 2, due to larger capacity for Cactus Hill Reservoir, increased Poudre Valley Canal transit distance, and higher evaporation rate at plains reservoir site.	Poudre River impacts identical to Alternatives 2 and 3, due to agricultural transfers being made from Larimer-Weld and New Cache canals, same as exchanges in other alternatives. Lesser flow impacts on the South Platte River due to reduced capacity SPWCP and smaller Galetton Reservoir.
2.	Stream Morphology					
	Poudre River PVC through Laporte	Significant effects unlikely.				

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Fort Collins to South Platte River	Significant effects unlikely.	Reduced peak season flows may cause: <ul style="list-style-type: none"> • Channel narrowing • Greater sediment deposition and less sediment flushing • Vegetation encroachment into the channel, especially in areas of greater sediment deposition • Increase in the size of in-channel islands • Flow obstruction and flooding • Bank erosion 			
	South Platte River	Significant effects unlikely.	Significant effects unlikely.			
3.	Surface Water Quality					
	Ammonia	Unknown	Ammonia increases may be measurable below WWTPs due to reduced river flows, may exceed standard at some locations			
Metals		Unknown	Increases and decreases in metal concentrations due to flow changes may not be measurable			

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Temperature/Dissolved Oxygen	Unknown	Temperature increases in summer due to flow decreases, resulting DO decreases, may exceed standards			
4.	Water Rights		The action alternatives would not adversely affect existing water rights.			
5.	Ground Water		During periods of high river flow, effects to alluvial ground water quantity/quality will be minimal. Diversions may increase the length of “dry up points” along Poudre during periods of low flow.	Minimal seepage from reservoir to alluvium could increase water availability to vegetation. No negative impacts to water quality.	Minimal seepage from reservoir to alluvium could increase water availability to vegetation. No negative impacts to water quality.	Minimal seepage from reservoir to alluvium could increase water availability to vegetation. No negative impacts to water quality.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
6.	Geology	No effects.	All actions will disturb surface geology associated with construction activities.	Change in sediment rates and patterns within the South Platte River associated with diversion dam at SPWCP. Excavation of rock for Glade Dam embankments, foundation, and rip rap. Excavation and removal of Paleozoic and Mesozoic sedimentary rocks associated with the U.S. 287 realignment.	Change in sediment rates and patterns within the South Platte River associated with diversion dam at SPWCP.	Change in sediment rates and patterns within the South Platte River associated with diversion dam at SPWCP. Excavation of rock for Glade Dam embankments, foundation, and rip rap. Excavation and removal of Paleozoic and Mesozoic sedimentary rocks associated with the U.S. 287 realignment
7.	Soils					
	Permanent impacts to Prime or other Important Farmland	15,731 ac.	455 ac.	243 ac.	1,535 ac.	15,695 ac.
8.	Vegetation					
	Permanent impacts to all vegetation	Unknown	Impacts associated with pipelines and SPWCP.	3,922–3,969 ac.	6,274–6,275 ac.	5,656–5,658 ac.
	Permanent impacts to native plant communities	Unknown		2,790–2,825 ac.	2,211 ac.	1,704–2,318 ac.
	Irrigated agricultural lands that would be dried up	69,200 ac.	0	0	0	17,137 ac.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
9.	Noxious Weeds	The removal of irrigation from agricultural lands is likely to increase the distribution and cover by noxious weeds.	All of the alternatives are likely to increase the distribution and cover by noxious weeds due to disturbance associated with construction, and for Alternatives 1 and 4 because of the removal of irrigation from agricultural lands.			The removal of irrigation from agricultural lands is likely to increase the distribution and cover by noxious weeds
10.	Wetlands and Other Waters					
	Wetlands (permanent)	1,384 ac. (dry-up)	Minor temporary effects associated with pipelines.	42–45 ac.	79 ac.	384–396 ac.
	Wetlands (temporary)	Unknown		9–11 ac.	16–19 ac.	9–19 ac.
	Waters (permanent)	Unknown		7 ac.	7 ac.	38 ac.
	Waters (temporary)	Unknown		9–11 ac.	90–91 ac.	9–91 ac.
11.	Riparian Resources					
	Riparian (permanent))	Unknown	Minor temporary effects associated with pipelines.	107 ac.	6 ac.	6–107 ac.
	Riparian (temporary)	Unknown		15–16 ac.	25–26 ac.	15–26 ac.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
12.	Wildlife					
	Big game species	Effects of gravel pit development on white-tailed deer and mule deer would be minor given the small proportion of affected habitat relative to the surrounding areas. Dry up of agricultural lands would affect irrigated riparian and wetland potentially used by big game, although impacts to specific big game habitats are not possible to quantify.	SPWCP forebay and diversion would result in the loss of 21 acres (<1% in GMU) of mule deer severe winter range.	Rounding to the nearest 50 acres for all subalternatives, permanent impacts to overall big game habitat include about 2,050 acres of elk habitat, 3,950 acres of mule deer habitat, 2,050 acres of white-tailed deer habitat, and 2,150 acres of pronghorn habitat. Overall ranges for all these species are relatively widespread in the affected GMUs, although more fragmented where development has occurred. Permanent impacts to about 167 acres of pronghorn severe winter range. Displacement of deer/elk east-west movements. Possible increased deer or elk vehicle collisions.	Rounding to the nearest 50 acres for all subalternatives, permanent impacts to overall big game habitat include 2,050 acres of mule deer habitat, 4,400 acres of white-tailed deer habitat, and 2,150 acres of pronghorn habitat. Overall ranges for all these species are relatively widespread in the affected GMUs, although more fragmented where development has occurred. No elk habitat would be impacted. Permanent impacts to about 167 acres of pronghorn severe winter range. Temporary impacts to 106 acres of pronghorn severe winter range and 12 acres of mule deer severe winter range.	Permanent impacts similar to Alternatives 2 and 3, depending on the reservoir.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Migratory birds and raptors, amphibians and reptiles, and other wildlife	Some species may disappear from the converted gravel pits and others may be attracted by created open water habitat. Changes in species composition not likely to affect population dynamics. Dry up of 69,200 acres of irrigated agricultural land, including 1,384 acres of low-moderate quality irrigated wetlands, would affect mostly generalist wildlife species. Many of the dried-up lands would probably be replaced by upland grassland habitat.	Temporary disturbance of wildlife habitat from construction of dam, spillway, roads, pipeline, and other facilities; to be revegetated. Changing water levels at Horsetooth Reservoir and Carter Lake would not affect wildlife. The reductions in streamflows on the Poudre and South Platte rivers associated with the action alternatives are not anticipated to cause a loss of riparian and/or wetland habitat. However, a reduction in the frequency of overbank flows may affect the periodic disturbance of the riparian zone that can create new riparian habitat.	Loss of 42 to 45 acres of wetlands, 7 acres of aquatic, 481 acres of shrub, and 2,730 to 2,747 acres of grassland habitat would impact associated species. Mortality and nest destruction could occur during construction. Temporary impacts include disturbance of vegetation and increased noise and human presence.	Direct impacts on species associated with aquatic, wetland, and riparian habitats are minimal. Loss of 79 acres of wetland, 8 acres of aquatic, and 5,069 to 5,070 acres of grassland habitat. Mortality and nest destruction could occur during construction. Temporary impacts include disturbance of vegetation and increased noise and human presence.	Direct impacts to wildlife similar to those for Alternatives 2 and 3, except fewer impacts on species associated with grassland habitat due to smaller Galetton Reservoir, and greater impacts on species associated with wetland habitats due to dry up of agricultural lands. Loss of 2,195 to 4,715 acres of grassland habitat. Dry up of 17,136 acres of irrigated agricultural land, including 353 acres of low-moderate quality irrigated wetlands and 31 acres of irrigated aquatic habitat. Losses of irrigated habitat would affect wildlife, including waterfowl, although most associated species are generalists. Dried-up agricultural lands would probably be replaced by upland grassland habitat.

	Resource/Issue			Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
13.	Fish and Other Aquatic Life							
	Cache la Poudre River	Upstream of Fort Collins	Fish	Unknown	Reduced runoff flows result in minor beneficial effect.			
			Invertebrates	Unknown	Reduced runoff flows result in minor beneficial effect.			
		Near Fort Collins	Fish	Unknown	Reduced winter flows result in minor adverse effect.			
			Invertebrates	Unknown	Reduced winter flows result in minor adverse effect.			
		Fort Collins to I-25	Fish	Unknown	Reduced runoff and increased winter flows result in minor beneficial effect.			
			Invertebrates	Unknown	Reduced runoff and increased winter flows result in minor beneficial effect.			
		I-25 to South Platte River	Fish	Unknown	Reduced runoff flows result in minor beneficial effect.			
			Invertebrates	Unknown	Reduced runoff flows result in moderate beneficial effect.			
	South Platte River	Downstream of Poudre River	Fish	Unknown		Reduced winter flows result in minor adverse effect.	Reduced winter flows result in minor adverse effect.	Negligible.
			Invertebrates	Unknown	Reduced runoff flows result in a minor beneficial effect.			

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
14.	Species of Concern					
	Preble's meadow jumping mouse	Preble's habitat assessments would need to be conducted and submitted to the Service for potential Preble's habitat that might be disturbed by the conversion of gravel pits to reservoirs, and consultation with the Service would be pursued, as appropriate. Losses of irrigated wetland and riparian habitat would not likely affect Preble's.	Changes in flows in the Poudre River are unlikely to affect Preble's. Effects mostly restricted to the periphery of localized areas. No known populations of Preble's occur in the Poudre River below Laporte where suitable habitat is unlikely to occur. Munroe Canal diversion would not likely result in impacts to vegetation or potential Preble's habitat.	Permanent loss of 50 acres of known Preble's habitat, mostly in southern portion of proposed Glade Reservoir. Temporary disturbance to 24 to 26 acres of Preble's habitat. Potential disturbance of Preble's behavior due to increased noise and human presence, and physical harm to individual Preble's from construction machinery and future recreational activities at Glade.	No permanent impacts to Preble's habitat from Cactus Hill or Galeton reservoirs, or SPWCP forebay and diversion. Temporary impacts to less than 1 acre of Preble's habitat from modifications of the Poudre Valley Canal. Although unlikely, potential Preble's habitat could occur in other wetland or riparian areas crossed by conveyance facilities, roads, or other project components. Habitat assessments or, if appropriate, trapping surveys for Preble's will be conducted prior to construction in potentially impacted Preble's habitat.	Impacts similar to those for Alternatives 2 and 3. Irrigated wetland and riparian habitat are unlikely to support Preble's; thus, losses of these habitats would not likely affect Preble's.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Bald eagle	Created open water habitat could attract bald eagles. Losses of irrigated agricultural land would not likely affect bald eagles.	Galeton Reservoir could provide additional summer foraging habitat for bald eagles, especially if stocked with fish.	About 0.9 mile of pipeline would be within 0.5 mile of a bald eagle nest, and portions of the pipeline would be located as close as about 250 meters from the nest site. Although pipeline construction impacts would be temporary, they could result in nest abandonment or decreased nesting success if conducted during sensitive breeding and nesting periods. Glade Reservoir could provide additional summer foraging habitat for bald eagles, especially if stocked with fish.	Cactus Hill Reservoir could provide additional summer foraging habitat for bald eagles, especially if stocked with fish. Less than 1 acre of habitat within 0.5 mile of a bald eagle nest would be temporarily impacted by modifications of the Poudre Valley Canal.	Impacts similar to Alternatives 2 and 3, depending on the reservoir. Losses of irrigated agricultural land would not likely affect bald eagles.
	Colorado butterfly plant	Losses of irrigated agricultural land would not likely affect CBP.	Prior to construction, CBP habitat assessments and/or final surveys are recommended for potentially impacted suitable habitat not previously evaluated. Changes in flows in the Poudre River are unlikely to affect CBP.	No CBP found during surveys of the Glade Reservoir and U.S. 287 study areas. No known populations of CBP occur in any of the study areas and it is unlikely that CBP occurs in the SPWCP pipeline and Glade to Horsetooth pipeline study areas. Thus, CBP is not likely to be adversely affected.	No known populations of CBP occur in any of the study areas and it is unlikely to occur in the SPWCP, Cactus Hill to Horsetooth, or Carter pipeline study areas. Thus, CBP is not likely to be adversely affected.	Impacts similar to Alternative 2 or 3. Losses of irrigated agricultural land would not likely affect CBP.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Ute ladies'-tresses orchid	Losses of irrigated agricultural land would not likely affect ULTO.	Prior to construction, surveys for ULTO are recommended for potentially impacted suitable habitat not previously evaluated. Changes in flows in the Poudre River are unlikely to affect ULTO.	No ULTO were found during surveys of the Glade Reservoir and U.S. 287 study areas. No known populations of ULTO occur in any of the study areas and it is unlikely that ULTO occurs in the SPWCP pipeline study area. The Glade to Horsetooth pipeline route would be less than 1 mile from currently known populations of ULTO. Prior to construction, ULTO habitat assessments and/or final surveys are recommended for potentially impacted suitable habitat not previously evaluated.	No known populations of ULTO occur in any of the study areas and it is unlikely to occur in the Poudre Valley Canal, SPWCP pipeline, and Cactus Hill to Horsetooth or Carter pipeline study areas. Thus, ULTO is not likely to be adversely affected.	Impacts similar to Alternative 2 or 3. Losses of irrigated agricultural land would not likely affect ULTO.
	Black-tailed prairie dog and burrowing owl	No impacts from conversion of gravel pits. Much of the dried-up agricultural lands would probably be replaced by upland grassland habitat, potentially providing new habitat.	Construction of Galeton Reservoir would result in permanent impacts to 247 acres of prairie dog habitat. Prairie dog colonies will be surveyed for burrowing owls prior to any work that would disturb them between March 15 and October 31.	Permanent impacts to 265 to 266 acres of prairie dog habitat, mostly from construction of Galeton Reservoir.	Permanent impacts to 312 acres of prairie dog habitat, mostly from construction of Galeton Reservoir.	Impacts similar to Alternative 2 or 3. Losses of irrigated agricultural land would not likely affect these species. Dried-up agricultural lands would probably be replaced by upland grassland habitat, potentially providing new habitat.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Swift fox	No impacts from conversion of gravel pits. Dried-up agricultural lands would probably be replaced by upland grassland habitat, potentially providing new habitat for swift fox.	Construction of Galeton Reservoir would result in permanent impacts to 1,240 acres (20,000 AF) and 1,828 acres (40,000 AF) of swift fox range. Construction activities should be avoided during swift fox breeding season at the Galeton Reservoir site.	Permanent impacts to 1,827 acres of swift fox range.	Permanent impacts to 1,827 acres of swift fox range.	Permanent impacts to 1,240 acres of swift fox range.
	Common gartersnake and northern leopard frog	Dry up of 1,384 acres of low-moderate quality irrigated wetlands could affect these species.		Loss of 42 to 45 acres of wetland habitat and 7 acres of aquatic habitat, mostly as a result of construction of the Glade Reservoir. Temporary impacts to 24 to 27 acres of wetland habitat and 9 to 10 acres of aquatic habitat.	Loss of 79 acres of wetland habitat and 8 acres of aquatic habitat. Temporary impacts to 41 to 44 acres of wetland habitat and 90 to 91 acres of aquatic habitat.	Impacts similar to Alternatives 2 and 3, depending on the reservoir. Additional loss of 353 acres of irrigated wetland/riparian habitat and 312 acres of irrigated aquatic habitat from agricultural dry up.
	Smokey-eyed brown butterfly, two-spotted skipper, and American currant	No effect on these species.		Same as all alternatives.	Same as all alternatives.	Same as all alternatives.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Bell's twinpod	No effect on Bell's twinpod.	None.	Loss of 26 to 29 acres of Bell's twinpod habitat. Temporary impacts to 43 to 44 acres of Bell's twinpod habitat as a result of the western realignment. If the northern alignment is chosen, surveys for Bell's twinpod should be conducted in the potentially impacted areas of suitable habitat prior to construction.	No Bell's twinpod habitat in any of the study areas. Potential habitat may occur in the Carter pipeline route east and south of Horsetooth Reservoir. Surveys of these areas should be conducted prior to construction.	Permanent impacts similar to those from Alternative 2 or 3, depending on the reservoir.
15.	Recreation Resources					
	Boating (kayaking and canoeing)	No impacts to boating.	Use of the Munroe Canal diversion may extend the acceptable flows and boating season into August for the Filter Plant Run. Tubing on the Poudre River would be unaffected by reduced flows.	If Glade is managed for recreational uses, new flat water boating opportunities would exist.	No public access is planned for Cactus Hill; therefore, boating would be unaffected.	Impacts to boating would be the same as Alternative 2 (Glade) or 3 (Cactus Hill).

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
Fishing		If gravel pits are stocked with fish, these sites may provide new fishing opportunities.	<p>Watson Fish Rearing Unit requires 25 cfs of flows during the winter months to which the District has stipulated.</p> <p>Galeton Reservoir would not provide a new fishery.</p> <p>Upstream of Fort Collins: minor beneficial effect to game fish habitat; therefore, minor beneficial impact on fishing.</p> <p>Near Fort Collins: minor adverse effect to game fish habitat; therefore, minor adverse effect on fishing.</p> <p>Fort Collins to South Platte: minor beneficial effect to fish habitat; therefore, minor beneficial effect on fishing.</p>	<p>If Glade is managed for recreation, it would provide a new fishery.</p> <p>South Platte River: minor adverse effect to fish habitat; therefore, minor adverse effect on fishing.</p>	<p>No public access is planned for Cactus Hill; therefore, there would be no effects to fishing.</p> <p>South Platte River: minor adverse effect to fish habitat; therefore, minor adverse effect on fishing.</p>	Impacts same as Alternatives 2 (Glade) and 3 (Cactus Hill). South Platte River: negligible effect to fish habitat; therefore, negligible effect on fishing.
	Hunting	No impacts to hunting.	Construction of SPWCP forebay would inundate the parking area and a portion of the access road for the Mitani-Tokuyasu SWA where hunting and trapping are a	430 acres of the Poudre River State Trust Land, which is managed for hunting and fishing by CDOW, would be inundated. However, construction of Glade Reservoir would potentially improve	No public access is planned for Cactus Hill; therefore, there would be no effects to hunting at the reservoir. However, construction of the reservoir may improve habitat,	Impacts to waterfowl habitat due to irrigated lands dry up may affect waterfowl hunting.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
			<p>recreational use. 21 acres of the SWA would be inundated. Mule deer winter range might be affected at the SPWCP forebay, therefore affecting nearby big game hunting.</p> <p>Pronghorn winter and severe winter range would be affected at the Galeton Reservoir site and may have an effect on nearby big game hunting opportunities.</p> <p>Depletions in the stream stage of the Poudre River might impact waterfowl habitat, therefore affecting recreational hunting.</p> <p>Construction of Galeton Reservoir may improve waterfowl habitat in the area, which may improve nearby hunting opportunities.</p>	habitat, therefore improving hunting opportunities.	therefore improving hunting opportunities at nearby lands.	

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
Other		No impacts to other types of recreation.	<p>Reductions in flows on the Poudre River are not expected to affect aesthetic qualities or riparian habitat of the Poudre or Poudre River trail or the Natural Areas.</p> <p>Construction of Galeton Reservoir may improve habitat in the area, which may improve nearby wildlife viewing or photography opportunities.</p> <p>Construction of SPWCP pipelines would temporarily disrupt dispersed recreational uses along its alignment.</p>	<p>Construction of the Carter pipeline would temporarily disrupt use of the Foothills trail in several places and would temporarily impact the aesthetic qualities of Horsetooth Reservoir Park, and the Reservoir Ridge, Maxwell, Pineridge, and Coyote Ridge natural areas.</p> <p>Construction of Carter or Glade to Horsetooth pipelines would temporarily disrupt other dispersed recreational uses along its alignment.</p>	<p>No public access is planned for Cactus Hill; therefore, there would be no impacts to other recreational activities at the site. However, construction of the reservoir may improve waterfowl habitat thereby improving wildlife viewing and photography opportunities at nearby lands.</p> <p>Construction of the Carter pipeline would potentially temporarily disrupt use of the Foothills trail in several locations and would temporarily impact the aesthetic qualities of Horsetooth Reservoir Park, and the Reservoir Ridge, Maxwell, Pineridge, and Coyote Ridge natural areas.</p>	Impacts same as Alternative 2 or 3, depending upon reservoir.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
16.	Cultural Resources	Impacts to cultural resources are unknown at this time, but probable.	15 cultural resources are located within the area of direct effect of Galeton Reservoir.	5 NRHP eligible cultural resources are located within the area of direct effect of Glade Reservoir and the U.S. 287 realignment. Combined with Galeton Reservoir, at least 20 cultural resources are located within the area of direct effect.	No cultural resources have been identified to date within the area of direct effect for Cactus Hill. At least 20 eligible cultural resources are located within the Galeton Reservoir area of direct effect.	Similar to those for Alternatives 2 and 3, depending on reservoir. No cultural resources have been identified to date within the area of direct effect for Cactus Hill. It is unknown at this time whether the transfer of agricultural lands would affect cultural resources.
17.	Aesthetics and Visual Resources	Visual effects associated with Alternative 1 would occur outside of the study areas included in the technical report, and are therefore unpredictable.	Potential effects to visual quality at new and existing (Carter and Horsetooth) reservoirs would be due to changing water surface elevations. More shoreline and less surface water area would be visible. Additionally a large majority of the Mitani-Tokuyasu SWA would be replaced by a forebay. Scenic quality would be significantly reduced at the location of the proposed forebay.	Visual effects associated with Alternative 2 would include the visual effects for the Glade and Galeton reservoirs and effects common to all action alternatives as described in the previous summaries.	Visual effects associated with Alternative 3 would include the visual effects for the Cactus Hill and Galeton reservoirs and effects common to all action alternatives as described in the previous summaries.	Visual effects associated with Alternative 4 would include the visual effects for Glade and Galeton reservoirs, and effects common to all action alternatives as described in the previous summaries. Additionally, the colors and textures of about 17,000 acres of irrigated agricultural lands would change. The change from irrigated crops (mostly green in straight long rows) to dryland crops (mostly light brown without a defined pattern) would be visible from very few locations including a relatively small

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
						portion of I-25. The change would have similar characteristics to some surrounding landscapes and would not create highly noticeable contrasts within any views.
18.	Traffic and Transportation					
	Traffic Volumes	No impact to traffic volumes.	None.	Existing traffic patterns are not expected to change; therefore, reduced traffic volumes are anticipated along SH 14 between Overland trail and Ted's Place. If recreational activities are provided at the Glade Reservoir site, minor seasonal fluctuations in vehicle volumes can be anticipated.		Impacts would be the same as Alternative 2 or 3, depending on the reservoir.
	Existing Roadways	No known impact to existing roads.	The location of the Galetton Reservoir would not infringe on or disturb any existing roadways.	A 5-mile portion of U.S. 287 would need to be relocated. Intersection control on SH 14 at the new U.S. 287 intersection would not change.	Local roads WCR 15, WCR 19, and WCR 90 would be directly impacted by construction of Cactus Reservoir. WCR 15 is proposed to be realigned approximately 1 mile east of the existing alignment, generally following the eastern edge of the reservoir. A	Impacts would be the same as Alternative 2 or 3, depending on the reservoir.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
					<p>portion of WCR 19 would have to be vacated between the Black Hollow Reservoir and WCR 94; similarly, a section of WCR 90, approximately 4 to 5 miles in length, would be inundated to accommodate the new reservoir.</p> <p>The location of the Galeton Reservoir would not infringe on or disturb any existing roadways.</p>	
	Current Travel Patterns	No known impact on current travel patterns.		<p>Various factors including topography, available right-of-way, and geological conditions would affect the ultimate alignment of the U.S. 287 highway segment. Therefore, it is unknown whether travel times for vehicles using U.S. 287 will increase or decrease. In either event, assuming that the speed limit does not change, the difference in travel times should not change by more than a few minutes.</p> <p>Access to Bonner Spring Ranch Road</p>	<p>Because existing roads would be inundated to accommodate the proposed Cactus Hill Reservoir, a new road would be built along the west side of the reservoir. The ultimate impact to vehicles using WCR 19 would be increased travel times (2 to 3 minutes) between SH 14 and WCR 96. Vehicles using WCR 90, however, would have to travel around Cactus Hill Reservoir via the new roadways and</p>	<p>Impacts would be the same as Alternative 2 or 3, depending on the reservoir.</p>

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
				may be affected by the realignment.	the existing WCR 96. This would add approximately 8 miles to their current route, increasing travel times for these vehicles by as much as 10 minutes.	
	Site Access	No known impact.	Construction of Galeton Reservoir would require extension of one of the existing roadways, or construction of a private drive for purposes of accessing and maintaining the facility.			Impacts would be the same as Alternative 2 or 3, depending on the reservoir.
Other				The realignment of U.S. 287 would not change the highway designations or the access control for either U.S. 287 or SH 14.		

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
19.	Land Use					
	Agriculture/Prime Farmland	69,200 acres irrigated cropland dry up; 11% overall loss of irrigated farmland in Larimer, Weld, Morgan, and Boulder counties.	State Land Board dry land crop lease would be affected by Galeton Reservoir. Galeton Reservoir would inundate 454.57 acres of Prime Farmland at 40,000 AF and 328.58 acres at 20,000 AF. The SPWCP forebay would permanently affect 20.86 acres of Prime Farmland.	Portion of Munroe Canal inundated by Glade Reservoir. The canal will either be realigned with the Poudre Valley Canal or routed under Glade Reservoir. Glade Reservoir would inundate 243.22 acres of Prime Farmland; equivalent to 0.001% of all Prime Farmland in Larimer County.	373.37 acres of State Land Board land would be inundated by Cactus Hill Reservoir. Cactus Hill Reservoir would inundate 1,535.14 acres of Prime Farmland, equivalent to 0.001% of all Prime Farmland in Weld County.	Dry up of 17,376 acres of irrigated cropland due to 21,500 AF of agricultural water transferred to municipal and industrial uses. This is 4.4% of all irrigated lands in the NISP study area. Of this acreage, 15,694.88 acres is considered Prime Farmland. Other impacts would be the same as Alternative 2 or 3, depending upon the reservoir.
Grazing		Grazing on dry up of irrigated lands would be affected.	A grazing lease would be affected on State Land Board lands at the Galeton Reservoir site. Degree of impact: 36.35 acres at 40,000 AF; 3.86 acres at 20,000 AF.	Grazing permittee to lose use on District lands. 340 acres of grazing lost on State Land Board lands. Portion of BLM land open for grazing applicant would be inundated, although steep terrain would prevent this use if permitted on this portion.	One grazing permit on State Land Board land would be partially affected (373.37 acres).	Impacts would be the same as Alternative 2 or 3 depending upon the reservoir. Additionally, grazing on irrigated lands from which irrigation would be removed would be affected.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Access	No impact to access.	Construction of the SPWCP forebay would inundate a portion of the access road and the parking area of the Mitani-Tokuyasu SWA.	CSU and Poudre School District access road into State Trust Land would be inundated. The District agreed to provide a new access for this purpose. Existing access to the Bonner Springs Ranch residential area from the south would be altered by the U.S. 287 realignment. Access to Horsetooth Reservoir via Larimer County Roads 23 and 38E would be temporarily disrupted by construction of Carter pipeline.	Weld County Roads (WCR) 15 and 19 would be inundated and realigned. Portions of WCR 88, 90, and 94 would be inundated. Access to Horsetooth Reservoir via Larimer County Roads 23 and 38E would be temporarily disrupted by construction of Carter pipeline.	Impacts would be the same as Alternative 2 or 3, depending upon the reservoir.
	Transportation	No impact to transportation.	The 31.1 miles of pipelines for the SPWCP would potentially disrupt some transportation uses, depending upon the alignment.	7.3 miles of U.S. 287 inundated by Glade; reroute required. Carter or Glade to Horsetooth pipeline construction would potentially disrupt some transportation, depending upon the alignment.	Weld County Roads (WCR) 15 and 19 would be inundated and realigned. Portions of WCR 88, 90, and 94 would be inundated. Carter or Cactus Hill to Horsetooth pipeline construction would potentially disrupt some transportation, depending upon alignment.	Impacts would be the same as Alternative 2 or 3, depending upon the reservoir.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Utilities	No impact to utilities.	The proposed Cheyenne-Totem gas pipeline is shown to partially parallel the SPWCP pipelines and cross through the SPWCP forebay.	Two power poles for a transmission line would be relocated for realigned U.S. 287.	230 kV transmission lines at the site would be relocated.	Impacts would be the same as Alternative 2 or 3, depending upon the reservoir.
	Natural Areas	No impact to natural areas.	Reservoir Ridge Natural Area would be temporarily disrupted during construction of either pipeline. Reservoir Ridge, Maxwell, Pineridge, and Coyote Ridge natural areas would be temporarily affected by the current alignment of the Carter pipeline alternative.		Reservoir Ridge Natural Area would be temporarily disrupted during construction of either pipeline. Reservoir Ridge, Maxwell, Pineridge, and Coyote Ridge natural areas would be temporarily affected by the current alignment of the Carter pipeline alternative.	Impacts would be the same as Alternative 2 or 3, depending upon the reservoir.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Urban/Residential	No impact to urban/residential uses.	The 31.1 miles of pipelines for the SPWCP would potentially disrupt some urban and residential uses, depending upon the alignment.	Construction of the Carter or Glade to Horsetooth pipeline would potentially disrupt some urban and residential uses, depending upon alignment.	11 residences would be inundated during construction of Cactus Hill Reservoir and 9 residences would be located within 1,000 feet of the reservoir. Construction of the Carter or Cactus Hill to Horsetooth pipeline would potentially disrupt some urban and residential uses, depending upon alignment.	Impacts would be the same as Alternative 2 or 3, depending upon the reservoir.
	Industry	No impact to industry.	No impact to industry.	No impact to industry.	Anheuser-Busch would lose private land used for wastewater disposal.	Impacts would be the same as Alternative 2 or 3, depending upon the reservoir.
20.	Socioeconomic Resources					
	Population growth and economic growth		No anticipated impact. Implementation of any alternative would not likely change land use or zoning plans of participant communities, increase employment opportunities, or increase other growth pressures compared to the No Action alternative.			

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Environmental justice	Unknown. The exact components and application of No Action projects are not known.		No Impact. Construction and operation of action alternatives do not disproportionately impact any minority or other environmentally sensitive populations.		
	Water bills (2020)	\$890/year, \$74/month		\$721/year, \$60/month	\$730/year, \$61/month	\$769/year, \$64/month
	Affordability of water bills		The Participants that are able to provide relatively affordable water service at present are projected to continue to have affordable rates in the future under any of the action alternatives. Participants with rates that currently exceed the affordability threshold are generally projected to continue to have relatively high rates through 2025 under each of the alternatives. Affordability of water service appears to be of most concern for Fort Lupton, Fort Morgan, and Morgan County Quality Water District.			

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
	Agriculture impacts from water quality	No Impact.	Adverse impact. Loss in production value of salt-sensitive crops due to water quality changes resulting from SPWCP amounts to less than 0.1% of current agriculture annual output (\$416,000 total impact from crop reduction).			
	Agricultural impacts from water transfers	Adverse impact. Lost production value from reduced agriculture output under No Action represents about 4.5% of total agriculture output in the region. Total economic impact is estimated to be a loss of approximately \$37.8 million annually.		No Impact.	No Impact.	Adverse impact. Lost production value represents about 3.32% of total agriculture output. Total economic effects are estimated to be a loss of approximately \$9.9 million annually.
	Recreational value	Potential for benefits if water storage facilities allow for public recreation such as swimming or fishing.		Offsetting impacts. Approximately \$0.30 to \$1 million in annual loss from Poudre River activities. Approximately \$17 million in benefit from recreation at Glade Reservoir.	Approximately \$0.30 to \$1 million in annual loss.	Offsetting impacts for Glade subalternative. Approximately \$0.30 to \$1 million in annual loss from Poudre River activities. Approximately \$17 million in benefit from recreation at Glade Reservoir.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
21.	Hazardous Sites		The action alternatives are not expected to contribute to or aggravate any hazardous material sites.	The proposed Glade Reservoir forebay is located near the Atlas “E” Missile Site 13 and a known TCE plume associated with the missile site.		Subalternative 4.1, see Alternative 2.
22.	Noise		Increased noise associated with construction would occur in localized areas temporarily during construction and traffic noise associated with a realigned U.S. 287.			
23.	Air Quality	Construction-related effects associated with the No Action alternative, as well as the associated emissions, would be more dispersed geographically.	All of the action alternatives should have similar levels of emissions because the types of construction equipment and construction schedules would be similar.			
24.	Energy Use		All of the action alternatives would rely on electrical energy to power pumps to pump water up to reservoirs or for the SPWCP to deliver water to canals for exchange.			

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
25.	Paleontological Resources (U.S. 287 only)	No impact.		<p><u>Northern and western realignment alternatives</u></p> <p>Adverse impacts to sub-surface fossils resulting from ground disturbance would be most likely in areas underlain by Class 5 geologic units (Morrison Formation). Adverse impacts to potentially significant vertebrate, invertebrate, plant and trace fossils would be possible in Class 3 geologic units (Niobrara Formation, Benton Group, Dakota Group, Undivided Jelm and Sundance Formations). Adverse impacts to potentially significant vertebrate, invertebrate, plant and trace fossils would be unlikely but are possible in Class 2 geologic units (Lykins Formation). Adverse impacts consist of destruction of fossils by breakage and crushing during construction-related ground disturbance. These impacts can be reduced to below the level of significance</p>		Same as Alternative 2, if Glade Reservoir.

	Resource/Issue	Alternative 1 No Action	Impacts Common to All Action Alternatives	Alternative 2 Proposed Action Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill, SPWCP, and Ag. Transfer
				with paleontological mitigation. Mitigation which would result in the salvage of fossils that would have otherwise have been destroyed, and the curation and permanent storage of these fossils in a public museum where they would be available for scientific research, education and display (beneficial impact).		

Table 4-21. Cumulative Effects by Resource.

Resource/Issue	Alternative 1 No Action	Cumulative Effects Common to All Action Alternatives	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Surface Water	Cumulative effects to streamflows may occur when the No Action alternative is combined with the HSWMPs and other projects in the region that affect streamflows. It has been assumed that the agricultural to M&I transfers will not affect streamflows.	The proposed HSWMPs, when combined with any of the action alternatives, will further reduce flows in the Poudre River from the NISP diversion locations downstream to the confluence with the South Platte River.			
Stream Morphology	In combination with the HSWMPs, additional reductions in the Laporte reach would increase channel stability, increase gradual minor encroachment of vegetation into channel and channel contraction, and would increase potential build-up of gravel and cobbles.				
Surface Water Quality	In combination with HSWMPs, additional reductions in flow could increase river temperature, lower dissolved oxygen concentration, and increase nitrite and dissolved solids concentrations from the canyon mouth to Fort Collins. WGFP could increase the nutrient concentrations in Horsetooth Reservoir; NISP could mitigate these effects. Augmentation of South Platte River wells could temporarily increase flows in South Platte River, temporarily mitigating NISP water quality impacts to South Platte River.				
Water Rights	No effect.	NISP would not contribute to a change in, or injury to, existing water rights, and there would not be cumulative effects to water rights associated with NISP under any action alternative.			
Ground Water	NISP would not adversely affect ground water; therefore, there would be no adverse cumulative effects of NISP in combination with reasonably foreseeable actions on ground water.				
Geology	No effect.	Construction of new reservoirs, such as the Chimney Hollow or Dry Creek reservoir for other water development projects within the NISP cumulative effects study area, and increased residential, commercial, and infrastructure development would further reduce the accessible geologic resources. Construction of additional water projects that affect Poudre and South Platte river flows upstream of the SPWCP will further alter sedimentation and sediment transport in the South Platte River.			
Soils	The dry-up of Prime or other Important Farmlands, if irrigated under the No Action alternative in combination with population growth on the northern Front Range, would further reduce the number of acres of Prime or other Important Farmlands available for irrigated crop production in the NISP cumulative effects study area.	In the NISP cumulative effects study area, about 343,121 acres of land are projected to change from agricultural uses or rangeland to residential, commercial, and industrial uses. Many of these activities would involve soil disturbances. The acreage of Prime or other Important Farmlands within these urban growth boundaries has not been calculated. However, it can be assumed that growth on the northern Front Range, in combination with inundation of Prime or other Important			The dry-up of Prime or other Important Farmlands, if irrigated under Alternative 4, in combination with population growth on the northern Front Range, would further reduce the number of acres of Prime or other Important Farmlands available for irrigated crop production in the NISP cumulative effects study area.

Resource/Issue	Alternative 1 No Action	Cumulative Effects Common to All Action Alternatives	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
		<p>Farmlands by the construction of the reservoirs, would reduce the number of acres of Prime or other Important Farmlands in the NISP cumulative effects study area.</p> <p>Construction of new reservoirs such as the Chimney Hollow or Dry Creek for other water development projects within the NISP cumulative effects study area would further reduce the number of acres of Prime or other Important Farmlands.</p>			
Vegetation	<p>It is likely that the regional trend of the loss of agricultural areas and changes in grassland vegetation types to developed areas, landscaped, or disturbed vegetation types would continue to occur, and the removal of irrigation from up to 69,200 acres of agricultural lands would add to this trend.</p>	<p>It is estimated that about 343,121 acres of land would change from agricultural uses or rangeland to residential, commercial, and industrial uses.</p> <p>Areas in the communities' planning boundaries that would be disturbed likely contain a wide variety of vegetation types, such as grasslands, woodlands, shrublands, and wetlands. In developed areas, it is likely that these vegetation types would change to landscaped areas, disturbed areas, or developed areas. The action alternatives would contribute to the regional trend of a loss of vegetation.</p>	<p>It is likely that over time, agricultural lands and other vegetation types would be converted to residential lands near Glade Reservoir. Residential lands probably would contain landscaped areas, disturbed areas, and developed areas.</p> <p>Other projects, including new reservoir development or enlargement, new residential development or future management of recreational activities in the study area may have cumulative impacts upon vegetation.</p>	<p>No reasonably foreseeable activities have been identified in the Cactus Hill study area which may have cumulative impacts upon vegetation other than the expansion of the North I-25 corridor. However, the impact analysis of the North I-25 expansion in combination with Alternative 3 have not been quantified because the impacts of the North I-25 project have not been determined.</p>	<p>Alternative 4 would directly affect about 17,137 acres of agricultural lands in Larimer and Weld counties, which would increase the regional trend of the transfer of agricultural water to M&I use, and the reduction of agricultural production in the region. In addition, Alternative 4 would have the same cumulative effects as for Alternative 2 or 3, dependent upon the reservoir.</p>

Resource/Issue	Alternative 1 No Action	Cumulative Effects Common to All Action Alternatives	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Noxious Weeds	The removal of irrigation from up to 69,200 acres would also increase the distribution and cover by noxious weeds.	The regional trend of the increase in the distribution of noxious weeds is anticipated to continue. All of the alternatives would add to this trend, and the cumulative effects of increased noxious weeds.			The removal of irrigation from 17,137 acres would also increase the distribution and cover by noxious weeds.
Wetlands and Other Waters	<p>The future projected development of 343,121 acres in the region could impact 3,431 to 6,862 acres of wetlands in the cumulative effects study area.</p> <p>The No Action alternative would dry up to 69,200 acres of agricultural lands, including an estimated 1,384 acres of wetlands, and would add to the cumulative impacts to wetlands.</p>	Future projected changes in land use, construction, and development are likely to impact wetlands and other waters. If about 1 percent (nonirrigated) to 2 percent (irrigated) of the areas that are developed in the cumulative effects study area planning boundaries (343,121 acres) are wetlands, then about 3,431 to 6,862 acres of wetlands would be impacted. The action alternatives would add to this regional trend.	<p>Permanent impacts to wetlands under Alternative 2 range from 42 to 45 acres.</p> <p>It is estimated that cumulative effects could be up to 6,909 acres under Alternative 2.</p> <p>Most of the cumulative effects to wetlands under Alternative 2 would occur from other activities in the cumulative effects study area, rather than NISP.</p>	<p>Alternative 3 would permanently impact about 79 acres of wetlands.</p> <p>It is estimated that cumulative effects could be up to 6,941 acres under Alternative 3.</p> <p>Most of the cumulative effects to wetlands under Alternative 3 would occur from other activities in the cumulative effects study area.</p>	<p>Total permanent impacts to wetlands under the Alternative 4 subalternatives (including impacts at the reservoir sites, pipelines, and agricultural lands) range from 384 to 396 acres.</p> <p>It is estimated that cumulative effects under Alternative 4 could range from 7,247 to 7,259 acres.</p> <p>Most of the cumulative effects to wetlands under Alternative 4 would occur from other activities in the cumulative effects study area.</p>
Riparian Resources		The NISP action alternatives, when combined with the HSWMPs, will further reduce high flows in the Poudre River between the canyon mouth and I-25, which will further reduce flows that disturb the floodplain and create and renew habitat for riparian vegetation establishment. Downstream of I-25, the combination of NISP and the HSWMPs will further aggravate the trend of riparian and wetland vegetation encroachment into the channel.			

Resource/Issue	Alternative 1 No Action	Cumulative Effects Common to All Action Alternatives	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Wildlife	In combination with impacts from the reasonably foreseeable actions, would likely result in additional cumulative losses of wetland and riparian habitat, and disturbance to nesting herons. The habitat that would be dried up generally is low quality because it is supported by flood irrigation with frequent disturbances.	The loss of wildlife habitat associated with the action alternatives would contribute to the regional trend of the loss and fragmentation of wildlife habitat. The losses of wildlife habitat associated with the action alternatives would be minor compared to the 343,121 acres of land use change and development projected for the region.	<p>In combination with other reasonably foreseeable actions, would result in cumulative losses of riparian and wetland habitat.</p> <p>Glade Reservoir and U.S. 287 realignment would contribute to disruption of deer and elk movement patterns.</p> <p>The cumulative effects of the Glade Reservoir and the proposed expansion of the Seaman Reservoir would further restrict deer and elk movements and could contribute to the geographic isolation of these herds.</p>	Other than those described for all action alternatives, no additional cumulative effects are anticipated for Alternative 3.	In addition to the effects described for all action alternatives, Alternative 4 would result in additional losses of wetlands and riparian habitats associated with the transfer of irrigation from irrigated agricultural lands.
Fish and Other Aquatic Life	No additional cumulative effects.	The NISP Action Alternatives combined with the HSWMPs would further reduce high flows in the Cache la Poudre River upstream of the Larimer-Weld Canal. The cumulative effects would be degraded water quality and increases in sedimentation, resulting in an adverse cumulative effect.	Other than those described for all action alternatives, there would be no additional cumulative effects.	Other than those described for all action alternatives, there would be no additional cumulative effects.	Other than those described for all action alternatives, there would be no additional cumulative effects.

Resource/Issue	Alternative 1 No Action	Cumulative Effects Common to All Action Alternatives	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Species of Concern	The No Action alternative would involve the development of gravel pits to store water. Excavation of these gravel pits could result in impacts to species of concern, but would occur independent of the No Action alternative. Based on the potential gravel pit locations, excavation of the gravel pits near the confluence of the Big Thompson and Little Thompson rivers and the Big Thompson and South Platte rivers could contribute to cumulative losses of occupied Preble's habitat, wetland and riparian habitat important to northern leopard frog and common gartersnake, and cumulative disturbance impacts to nesting and roosting bald eagles. Structures associated with water storage in these gravel pits may permanently impact wetlands and riparian areas. Because these gravel pits would already exist, however, it is likely that the contribution to cumulative impacts from the No Action alternative would be minor and would occur from activities such as placement of inlet and outlet structures.	Cumulative losses and fragmentation of grassland habitat potentially supporting the black-tailed prairie dog, burrowing owl, and swift fox would occur due to the action alternatives and projected development.	Alternative 2, in combination with other reasonably foreseeable actions, would have greater cumulative impacts than the other action alternatives to cumulative losses of habitat for Preble's, common gartersnake, and northern leopard frog. In addition, the construction of Glade Reservoir and the realignment of U.S. 287 included in Alternative 2, as well as development of the former Holcim property, would likely result in cumulative effects on Bell's twinpod.	Other than those described for all action alternatives, no additional cumulative effects are anticipated for Alternative 3.	In addition to the effects described for all action alternatives, Alternative 4 would result in additional losses of wetland and riparian habitats due to the dry-up of irrigated lands. The agricultural wetlands, ponds, and ditches that would be dried up generally provide low- to moderate quality habitat because they are supported by flood irrigation and are often subjected to tilling, dredging, grazing, and other disturbances. However, it is possible that the northern leopard frog and common gartersnake could be affected.

Resource/Issue	Alternative 1 No Action	Cumulative Effects Common to All Action Alternatives	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Recreation Resources	Projected population growth and land development would result in increased recreation demands on existing recreation resources. The No Action alternative is not anticipated to incrementally add to the increased demand for recreation.	The new water craft course planned for Fort Collins on the Poudre River is anticipated to bring more recreationists to the Poudre River in Fort Collins. Projected population growth and residential development within the cumulative effects study area would likely increase the demand for recreational opportunities over time. Reductions in flows on the Poudre River due to NISP in conjunction with the HSWMPs may adversely further affect recreational boating use of both the Filter Plant Run and the proposed water craft course. Additional cumulative impacts to recreational value may occur.	The trend in increased population growth and increased recreational demands in the study area is anticipated to continue. If managed for public recreation, Glade Reservoir could serve an increased demand for recreation in the region. This would provide a positive cumulative effect by meeting increasing demands for recreation in the area and may reduce crowding at nearby Horsetooth Reservoir and Carter Lake.	No reasonably foreseeable actions have been identified with potential cumulative effects to recreation under Alternative 3.	Cumulative effects to recreation under Alternative 4 would be the same as Alternative 2 or 3, dependent upon the reservoir.
Cultural Resources	The land-based cumulative effects would affect about 343,121 acres of land that would change from agricultural uses or rangeland to residential, commercial, and M&I uses. Many of these changes would involve ground-disturbing activities that would likely affect cultural resources due to increased clearing of land. Many of the land use changes and surface disturbances would occur without federal actions and a requirement to address and mitigate effects to cultural resources. Conversely, the effects to cultural resources associated with the alternatives would be determined and mitigated if the action is subject to federal, state, or local government cultural resource requirements, but would add to the incremental cumulative effect to cultural resources in the region.				

Resource/Issue	Alternative 1 No Action	Cumulative Effects Common to All Action Alternatives	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Aesthetics and Visual Resources	Dry-up of agricultural lands under the No Action alternative in combination with population growth would contribute to the loss of visual quality in the northern Front Range.		New homes in the proposed Glade Reservoir area would benefit from increased scenic quality due to presence of water in their views to the south and east.	Within the Cactus Hill Reservoir study area, a proposed single-family residential subdivision is planned near the southwest corner of the proposed dam. A portion of the subdivision would be within the visibility area of the dam. Because the visibility area of the subdivision would be below the top of the proposed dam, scenic quality would be reduced for some of the proposed homes with views only of the face of the dam. The proposed subdivision combined with Cactus Hill Reservoir would have a cumulative effect on the visual quality of the area.	Dry-up of 17,137 acres of irrigated agricultural lands under Alternative 4 in combination with population growth and urban growth would cumulatively affect the visual quality of lands in the northern Front Range. Other cumulative effects to visual resources under Alternative 4 would be similar to either Alternative 2 or 3, dependent upon the reservoir.
Traffic and Transportation	The No Action alternative is not expected to affect traffic and transportation; therefore, it would not contribute to the cumulative effects of other activities in the area.		Population growth and land development in the northern Front Range would increase traffic on U.S. 287. Recreational use at the reservoir (if it is managed for recreation) also is expected to alter traffic patterns at Glade Reservoir. Cumulative effects of the realignment of U.S. 287 and nearby residential development would increase noise and night lighting over time. Expansion of the I-25 corridor, in combination with the realignment of U.S. 287, would also impact regional traffic and transportation. County road improvements in the Galeton Reservoir area may be necessary as the population of the northern Front Range grows.	With population growth, increased traffic likely will necessitate roadway improvements in the vicinity of Cactus Hill and Galeton reservoirs. Cumulative impacts to traffic and transportation associated with Alternative 3, in combination with population growth and land development, would be related to a longer commute and increased traffic for those individuals commuting around Cactus Hill Reservoir on the realigned county roads.	Cumulative impacts to traffic and transportation under Alternative 4 would be the same as for Alternative 2 or 4, dependent upon the reservoir.

Resource/Issue	Alternative 1 No Action	Cumulative Effects Common to All Action Alternatives	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Land Use	Alternative 1, in combination with population and urban growth, would have cumulative effects on agricultural uses in the northern Front Range, by adding to the trend of transferring irrigation from agricultural lands to M&I use. This would add to the reduction of agricultural land and agricultural production in the region.	<p>Planned additional urban acreages (343,121 acres) represent lands that would be converted from agricultural uses or rangeland to residential, commercial, or industrial uses. The construction of NISP facilities under all action alternatives, in combination with this planned growth, would contribute to these land use changes. However, the majority of these land use changes would occur with future projected development and not the action alternatives.</p> <p>The expansion of the I-25 north corridor also will likely have an additional impact on many land uses in the northern Front Range.</p> <p>The construction of a new reservoir, Glade or Cactus Hill, in combination with the construction of reservoirs such as Chimney Hollow and Dry Creek, or the expansion of reservoirs such as Halligan and Seaman, would have cumulative effects associated with the additional loss of agricultural lands.</p>	The loss of some agricultural uses due to inundation by Glade Reservoir, in combination with the loss of agricultural land uses associated with population growth, would increase the loss of agricultural land use over time.	The loss of some agricultural uses due to the inundation of lands by Cactus Hill Reservoir, in combination with the loss of agricultural land uses associated with future population growth and development, would increase the loss of agricultural land use over time.	The agricultural transfers under Alternative 4, in combination with the loss of agricultural land uses associated with population growth, would substantially increase the loss of agricultural land use over time.

Resource/Issue	Alternative 1 No Action	Cumulative Effects Common to All Action Alternatives	Alternative 2 Glade and SPWCP	Alternative 3 Cactus Hill and SPWCP	Alternative 4 Glade or Cactus Hill and SPWCP and Agricultural Transfers
Socioeconomics	The No Action alternative would accelerate the trend of transferring irrigation water to M&I use.	NISP, in combination with the HSWMPs could reduce streamflows of the Poudre River. These effects are likely to increase the significance of impacts associated with reduced flows.	In addition to the impacts common to all action alternatives, Alternative 2 would not accelerate and may contribute to slowing the trend of converting irrigation water to M&I use, when compared to the No Action alternative and Alternative 4.	In addition to the impacts common to all action alternatives, Alternative 3 would not accelerate and may contribute to slowing the trend of converting irrigation water to M&I use, when compared to the No Action alternative and Alternative 4.	Alternative 4 would not accelerate the trend of converting irrigation water to M&I use as much as the No Action alternative, but conversion would take place. This conversion would likely be in the Poudre Basin, in contrast to the incremental and scattered nature assumed for the No Action alternative.
Hazardous Sites	No Effect	No Effect	No Effect	No Effect	No Effect
Noise	All of the alternatives would add to the cumulative noise effects over the short term due to construction.				
Air Quality	All of the alternatives would add to the cumulative air quality effects over the short term due to emissions from construction equipment, travel to and from construction sites, and increases in fugitive dust.				
Energy Use	No effect, assuming no additional pumping would be needed to operate facilities.	All of the alternatives would add to the cumulative use of energy over the short term associated with construction. All of the alternatives will add to the long-term cumulative use of energy associated with project operations (e.g., pumping).			
Paleontology	No Effect	No Effect	If previously unknown scientifically significant paleontological resources are discovered within the APE for U.S. 287 under any alternative during construction, the potential cumulative impacts would be low, so long as mitigation measures are implemented to salvage the resources.	No Effect	Subalternative 4.1 would be the same as Alternative 2. Subalternative 4.2 would have no effect.

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Chapter 5

Environmental and Other Commitments

The District has agreed to avoid, minimize, and compensate the effects of the alternatives. An overview of mitigation is provided in this Chapter. Mitigation options identified in this chapter are strategies that the Applicant, Corps, and cooperating agencies are considering. Their inclusion does not imply that all options listed will be implemented. It is anticipated that other mitigation strategies may be identified with comments on the Draft EIS. Final mitigation requirements by the Corps will be based on the requirements of its regulations and the mitigation's adequacy and practicability to offset impacts from the project that would be authorized by the Corps. Further refinement of appropriate mitigation measures will occur and will become part of any permit issued by the Corps as conditions. Monitoring requirements for mitigation also will be established as permit conditions.

5.1 AQUATIC RESOURCES

5.1.1 Wetlands and Habitat for Preble's Meadow Jumping Mouse

5.1.1.1 Compensatory Mitigation

To mitigate for direct impacts to wetlands and Preble's habitat associated with Glade Reservoir, the District will construct a series of depressions between the Glade Reservoir dam and forebay on

either side of Owl Creek, a tributary to the Cache la Poudre River. The depressions will be designed to have high quality functions for general wildlife habitat, sediment nutrient/toxicant removal, and production export/food chain support, and provide up to 56 acres of wetland and aquatic habitat. The depressions and associated habitat will provide suitable habitat for Preble's meadow jumping mouse (Preble's). The wetland complex will be constructed concurrent with construction of the dam and forebay.

Alternative 1—No Action Alternative. Under the No Action alternative, existing gravel pits along the Cache la Poudre River, the South Platte River, the Big Thompson River, and Boulder Creek would be developed as water supply storage reservoirs. Impacts to wetlands from the mining of aggregate would be mitigated as part of mining operations. Impacts to wetlands from conversion of gravel pits to water storage ponds would likely be minor and would be replaced in areas along the edges of these ponds either through natural processes or by construction of wetlands. All or some of the following methods could be used to construct these wetlands:

- Steep banks would be graded back to establish wetlands within 1 foot above the edge of the ponds.
- In areas with unsuitable soil conditions, wetland topsoils (if available) would be spread in the wetland mitigation areas.
- Appropriate native wetland herbaceous and shrubby vegetation would be planted or seeded in the mitigation areas.

Under the No Action alternative, about 1,384 acres of irrigated wetlands would be lost. A combination of actions would likely be used to mitigate the loss. These actions could include the purchase of mitigation banking credits, preservation of high quality wetlands in the region, and wetland creation. However, the transfer of water from agriculture uses

to M&I has not typically involved compensatory mitigation for wetlands lost due to the removal of irrigation because these wetland losses would occur as individual water right transactions.

Alternative 2—Proposed Action—Glade Reservoir and the SPWCP. This alternative would permanently impact 42 to 45 acres of wetlands (depending on the subalternative selected). The majority of these impacts can be compensated by the creation of wetlands below Glade Reservoir. Impacts to wetlands from the U.S. 287 realignment would be mitigated by creating replacement wetlands in the area west of the realignment area.

Glade Reservoir Mitigation Site. The following three types of mitigation are proposed for the area south of the Glade Reservoir dam site.

Between the Dam and Forebay. A series of depressions would be constructed between the dam and forebay on either side of the existing tributary to the Cache la Poudre River. These wetlands would be designed as a series of depressions where water seeping from the toe drains of the dam and/or water diverted from the forebay would slowly flow through the depressions, creating wetland hydrology and supporting wetland vegetation. The wetlands would be designed to have similar functions and values as the large herbaceous wetlands near the existing U.S. 287 that would be inundated by the proposed Glade Reservoir. Appropriate native herbaceous wetland species would be planted. Along edges, especially near Owl Creek, native trees and shrubs would be planted to provide woody riparian habitat for wildlife, especially the threatened Preble's meadow jumping mouse. These replacement wetlands would be designed to have high quality functions for general wildlife habitat, sediment nutrient/toxicant removal, and production export/food chain support.

Wetland Fringe Around Forebay. Wetlands would be constructed on a shallow shelf around the edge of the forebay. This shelf would be constructed between about 1 foot above and 1 foot below the normal water level of the forebay. Appropriate native wetland plants would be planted. Along the outer edges, cottonwoods, sandbar willows, and other appropriate native trees and shrubs would be planted. These replacement wetlands would be designed to have high quality functions for general wildlife habitat and sediment/shoreline stabilization.

North of the Cache la Poudre River. A series of wetland depressions would be constructed on the broad floodplain north of the Cache la Poudre River and west of Owl Creek. Appropriate native wetland herbaceous materials would be planted. Along the edges, especially near the tributary to the Cache la Poudre River, native trees and shrubs would be planted to provide woody riparian habitat for wildlife, especially for the threatened Preble's meadow jumping mouse. These replacement wetlands would be designed to have high quality functions for general wildlife habitat, sediment nutrient/toxicant removal, and production export/food chain support.

The 56 acres of proposed mitigation for wetlands is larger than the total permanent wetland impacts for Alternative 2 (between 42 and 45 acres) because this plan is preliminary and conceptual. During final design, the size of the proposed wetland mitigation sites would be adjusted to replace the wetlands lost on an acre-for-acre basis with wetlands similar in types and functions provided for the wetlands lost.

The integration of compensatory wetland mitigation with the mitigation for Preble's habitat would provide a complex of wetlands and riparian habitat of trees and shrubs with vegetated uplands, which will provide a buffer to the wetland/riparian complex. This complex will provide high quality

habitat for Preble's, a threatened species, and provide wetland functions that are equal to or greater than the functions lost.

U.S. 287 Realignment Mitigation Site. The U.S. 287 realignment would permanently impact 2.6 acres of wetlands for the western alignment and 0.9 acre of wetlands for the northern alignment. Compensatory mitigation to replace these wetlands would be constructed adjacent to existing Wetlands 14 and 15 and the connecting intermittent stream in an area south (downgradient) of the Poudre Valley Canal. The mitigation site would be graded to the elevation of the existing wetlands. Water from the adjacent intermittent stream and, if necessary, the Poudre Valley Canal, would support these wetlands. Herbaceous wetland vegetation similar to the vegetation growing in wetlands impacted in the U.S. 287 realignment study area would be seeded and/or planted in the mitigation site. These wetlands would be designed to replace the functions and values of the wetlands impacted in the U.S. 287 realignment study area, such as general wildlife habitat, sediment nutrient/toxicant removal, and production export/food chain support.

Alternative 3—Cactus Hill Reservoir and the SPWCP. Alternative 3 would permanently impact about 79 acres of wetlands from Cactus Hill Reservoir, SPWCP, and lining of the Poudre Valley Canal. Permanent impacts could be compensated by the creation of wetlands at the southern end of Black Hollow Reservoir. Two types of wetlands currently exist around Black Hollow Reservoir, cattail marshes (palustrine emergent) and sandbar/peachleaf willow (palustrine scrub-shrub) wetlands. The cattail marshes occur next to the open water in shallowly inundated to saturated areas. Sandbar willow wetlands typically occur in slightly higher seasonally saturated areas. The compensatory mitigation areas would be designed as either cattail marshes or sandbar/peachleaf willow wetlands,

depending on the location and topography. Some peachleaf willows currently grow in the upland areas proposed as mitigation; these trees may need to be removed to create the elevations needed for the mitigation wetlands. Peachleaf willows and other appropriate native trees would be planted as part of mitigation.

The 48 acres of proposed mitigation would offset about half of the losses. The remaining wetland losses would be mitigated by a combination of mitigative actions similar to those described under Alternative 1.

Alternative 4—Glade or Cactus Hill Reservoir and SPWCP and Agricultural Transfers. Alternative 4 would permanently impact between 385 and 397 acres of irrigated wetlands, depending on which subalternative is chosen. A combination of actions would likely need to be used to mitigate the large area of irrigated wetlands that would be lost. These actions could include the purchase of mitigation banking credits, preservation of high quality wetlands in the region, and wetland creation. However, typically the transfer of water from agriculture uses to M&I has not involved compensatory mitigation for wetlands lost due to the removal of irrigation because these wetland losses would occur as individual water right transactions without federal permitting.

5.1.2 Fisheries

5.1.2.1 Enhancement of Streamflows Above the Mouth of Poudre Canyon

To mitigate for impacts to aquatic resources associated with Alternative 2, the District will pursue the enhancement of winter streamflows of the Poudre River from approximately Poudre Falls (or higher) to the diversion for Glade Reservoir. The District would pursue the addition of 10 cfs for

November through February by working with the owners of water rights in the upper Poudre Basin. The 10 cfs would be in addition to the 10 cfs winter augmentation of flows currently provided by the Joint Operations Plan. The District would provide up to 2,000 AF of space annually to store winter augmentation flows that would be released from reservoirs in the upper basin. This stored water would then be released for use by the original owner of the water. The District does not own a reservoir in the upper Poudre Basin and would need to work cooperatively with another water provider to contribute additional wintertime streamflow to the Poudre River. The enhanced winter flows would help provide water for fish during the winter when fish are stressed by low flows and shallow water. The flow enhancement would occur over about 49 miles of a high quality coldwater fishery.

5.1.2.2 Enhancement of Streamflows Through Fort Collins

To mitigate for impacts to aquatic resources associated with Alternative 2, the District commits to work with CDOW to enhance Poudre River winter flows primarily through Fort Collins for the purpose of enhancing a fishery on this reach of the Poudre River. The primary target reach starts at the Larimer-Weld Canal headgate just west of Shields Street and extends downstream to Mulberry Street, a distance of 3.7 miles. Enhancement will take place through a number of possible methods including the following:

- Work with CDOW to determine a long-term plan for creating the fishery.
- Construct low-flow bypass structures on the Terry Lake inlet and Larimer-Weld Canal inlet.
- Release flow from Glade Reservoir for recapture at the SPWCP pump station.
- Coordinate with existing irrigation companies to re-time existing reservoir inflows.

- Coordinate Glade Reservoir operations with irrigation companies for potential flow re-timing.
- Assist in potential channel improvements for fishery enhancement.
- Take an active role in the region to promote the creation of the fishery and work with others over the long term to achieve this goal.

Any enhancement of flows of the Poudre River will need to consider priorities for flow enhancement and project operations. For example, enhancing winter flows of the Poudre River above the canyon mouth (Section 5.1.2.1) would require storing flows at Glade Reservoir from higher in the Poudre River basin. Enhancement of winter streamflows through Fort Collins would require releasing flows from Glade Reservoir during the winter.

5.1.2.3 Curtailment of Diversions from the Poudre River During the Winter

To help improve the fishery on the Poudre River from the canyon mouth through Fort Collins, the District will curtail diversions from the Poudre River whenever flows at the canyon gage fall below 25 cfs from November 1 to April 15, provided the District can be assured that the passed water will flow through Fort Collins and not be diverted by junior appropriators. The curtailment of diversions will be administered in cooperation with the SEO and may require additional flow measurement locations.

5.1.2.4 Stream Habitat Enhancement

The District is proposing to develop and implement a stream habitat enhancement plan (Plan) for an approximate 0.5-mile reach of the Poudre River in the vicinity of the Watson Fish Hatchery. The Plan will mitigate for impacts to aquatic life and riparian habitat associated with the action alternatives, will be coordinated with, and approved by, the Colorado Division of Wildlife (CDOW), and will address

increasing the channel depth, adding structure and diversity to the stream habitat and establishing woody riparian vegetation. As part of this Plan, the District will work with CDOW to design and fund modifications to the existing Watson Lake intake and diversion structure to minimize drying up of the Poudre River that currently occurs in this reach. The Plan will be implemented prior to the filling of Glade Reservoir.

5.1.2.5 Establish Reservoir Fishery

If an alternative with Glade Reservoir is permitted, the District will coordinate with CDOW to establish a sport fishery in Glade Reservoir. The establishment and management of the fishery will be the responsibility of CDOW. If requested by CDOW, the District will provide bottom contours and structures to enhance the reservoir fishing as part of reservoir construction. The District will provide public access to the Glade Reservoir fishery.

5.1.2.6 Establish Glade and Galeton Forebay Fishery

The District will coordinate with CDOW to establish a sport fishery in the Glade and Galeton Reservoir forebays. The District will be responsible for designing and managing the forebays to support a fishery and CDOW will be responsible for establishing and managing the fishery. The District will provide public access to the forebays.

5.1.2.7 Reintroduction of Native Fish Species

The District will coordinate with CDOW to reintroduce rare fish species into the Poudre River drainage. There are several small warmwater fish species being raised in the CDOW hatchery in Alamosa that would be appropriate to stock in isolated locations in the Poudre River drainage downstream of Fort Collins. These reintroductions would be done in isolated, off-channel habitats, such

as backwater and floodplain pools, that give these species protection from nonnative species that would eat or out-compete the rare fish. Over time, the rare species may escape from these areas and recolonize the Poudre River. These introductions would probably involve a combination of existing and created off-channel habitat areas.

CDOW has expressed interest in possibly using the Galeton facilities to establish a facility for raising native fish for reintroduction. The District will coordinate with CDOW on development of such a facility for the Galeton forebay if CDOW wants to pursue such a facility.

5.1.3 Riparian Trees

5.1.3.1 Replacement of Lost Native Riparian Trees

Direct impacts to native riparian trees from construction activities will be minimized as much as practicable. To compensate for unavoidable tree removal, native riparian trees less than 6 inches in diameter at breast height (dbh) will be replaced with a native tree with a minimum 1-inch caliper; native and nonnative trees greater than 6 inches dbh will be replaced with three 2-inch native trees or two 3-inch native trees. All native trees scheduled for removal will be identified; marked for removal; and the species, location, and dbh recorded. Trees will be obtained from a reputable nursery at the time of planting. Planted trees will be watered during the first year or as long as needed to ensure establishment.

5.1.4 Environmental Streamflows

The District has stipulated the Grey Mountain water right to three streamflow requirements on the Poudre River used to benefit fishery, recreation, and other environmental purposes (Table 5-1). The District

will curtail its diversions from the Poudre River for NISP when the streamflow requirements for each of the facilities listed in Table 5-1 occur and CDOW (Watson Lake Fish Hatchery) or Fort Collins (boat chute and nature center) places a call on the river for the streamflows. The District also will curtail its diversions from the Poudre River for NISP when the streamflow requirements for each of the facilities listed in Table 5-1 occur, provided the District can be assured that the passed water will reach the facilities and not be diverted by junior appropriators. The District will install and monitor gages to determine if flows passed by NISP reach the facilities.

Table 5-1. Environmental Streamflows Included in the Hydrology Modeling for the Poudre River Water Rights.

Location	Streamflow Requirement	Purpose
Watson Lake Fish Hatchery	25 cfs (Nov. 1 – April 14); 50 cfs (April 15 – Oct. 31)	Water to maintain CDOW fish hatchery
Fort Collins Boat Chute	5 cfs (Sept. 1 – April 30); 30 cfs (May 1 – Aug. 31)	Used for recreation, fishery, and wildlife habitat
Fort Collins Nature Center	5 cfs (Sept. 1 – April 30); 30 cfs (May 1 – Aug. 31)	Used for recreation, fishery, and wildlife habitat

5.1.5 Fossil Creek Reservoir Inlet Operations

Under current river administration, the entire flow of the Cache la Poudre River is frequently diverted into Fossil Creek Reservoir inlet canal located about 7 miles downstream of downtown Fort Collins. This results in the dewatering of up to 5.4 miles of the Cache la Poudre River where flows released from

Fossil Creek Reservoir are discharged to the river. Return flows adding flow to the river occur immediately downstream of the Fossil Creek inlet dam as evidenced by the flows recorded at the USGS Boxelder gaging station located 1.8 miles downstream. The District commits to working with the District 3 River Commissioner and owner of the Fossil Creek Reservoir diversion structures to modify the diversion to pass a minimum of 30 cfs to the river when diversions are being made to Glade Reservoir. Additionally, the District will pursue working cooperatively with other diverters to extend the bypasses from May through October. This will seasonally provide aquatic habitat to about 5.4 miles of the Cache la Poudre River that is dry or lacks suitable flows for aquatic life for much of the year.

5.1.6 Riparian Resources

Riparian resources along reaches of the Poudre River may be affected by reduced streamflows during the growing season. The stream habitat enhancement project (Section 5.1.2.2), environmental streamflows (Section 5.1.4), reoperation of the Fossil Creek Reservoir inlet (Section 5.1.5), and enhancement of Poudre River flows through Fort Collins are intended to mitigate many of the effects of reduced flows on riparian vegetation. The primary indirect effect to riparian vegetation is anticipated to be the reduction in the infrequently occurring overbank flows that provide periodic disturbance of the riparian zone that can aid in creating new habitat for riparian vegetation establishment and rejuvenation of the riparian zone. These indirect effects are estimated to occur primarily upstream of I-25. The District will work with land managers along the Poudre River from the canyon mouth to I-25 to identify areas suitable to plant native woody riparian vegetation and disturb decadent stands of woody riparian vegetation to help

compensate for the reduction in disturbance from reduced overbank flows. The District will also develop a plan to be approved by the Corps for periodically curtailing diversions from the Poudre River for at least 24 hours during high flows, which could provide the riparian areas with periodic disturbance and inundation. The diversion curtailment plan will be implemented provided the District and Corps can be assured that the passed water will flow to at least I-25 and not be diverted by junior appropriators.

5.2 RECREATION

5.2.1 Glade Reservoir

The District will seek a qualified vendor or lessee (e.g., Larimer County or Colorado State Parks) to develop a recreation plan and manage recreation at Glade Reservoir. The District would fund development of the recreation plan and prior to implementation, the recreation plan would have to be approved by the District.

The CDOW has requested that any loss of public access or field hunting terrain be compensated through replacement of the access or field hunting terrain equivalent to the existing conditions.

5.2.2 Cactus Hill Reservoir

The CDOW has requested that any loss of public access or field hunting terrain be compensated through replacement of the access or field hunting terrain equivalent to the existing conditions.

5.2.3 Enhance River Flows Through Fort Collins

The District will seek an agreement with the Lake Canal Company to move diversions from the Lake Canal intake on the Poudre River near College Avenue to the Timnath Reservoir Inlet Canal about 3 miles downstream. On average, moving the diversions from the Lake Canal downstream would add about 50 cfs to the Poudre River for 6 weeks from late May to early July. The District does not control the water diverted by the Lake Canal, but will work with the canal company and any opposers to the change in diversion location to accomplish the change. Relocating this diversion point would allow for higher flows in the Poudre River through the City of Fort Collins, which would reduce some of the recreational impacts expected to otherwise result from the action alternatives.

The District will also explore agreements with other water providers to retime their direct flow rights by temporarily storing water in Glade Reservoir and/or its forebay for release during late July and August. Such agreements would add to the flows of the Poudre River through Fort Collins during the summer.

5.2.4 Modify Diversion Structures for Boat Passage

The District will explore the modification of the Munroe Canal diversion and the Fort Collins Water Treatment Plant diversion to facilitate boat passage. Currently, these diversions are obstacles to boaters. Modifying these diversions for boat passage would extend the “Bridges Run” of the Poudre River downstream to Gateway Park and link it to the beginning of the “Filter Plant Run.” This would add about 2 miles of continuous boatable water between the Bridges and Filter Plant runs. The District will

work with the owners of the diversion structures and representatives of the local boating community to design the passages and will submit a modification plan for the diversions to the Corps prior to the construction of a permitted reservoir alternative.

5.2.5 Mitani-Tokuyasu State Wildlife Area

The District will continue to provide public access to the Mitani-Tokuyasu SWA and would provide substitute facilities comparable to any existing facilities that would be lost at the SWA due to construction and operation of the SPWCP. The District will coordinate with CDOW regarding impacts to the SWA, and the proposed replacement of facilities would need to be approved by CDOW. At this time, the only facilities known to need replacement are public parking and a portion of the access road. CDOW has requested that if field hunting opportunities are lost due to the construction of the forebay, that there would be an equivalent replacement for those opportunities provided by the District.

5.3 THREATENED AND ENDANGERED SPECIES ACT COMPLIANCE

The District agrees to implement all of the reasonable and prudent alternatives, reasonable and prudent measures, and terms and conditions of the Biological Opinion that the Corps incorporates as conditions for the Section 404 permit.

5.3.1 Preble’s Meadow Jumping Mouse

Compensatory Habitat Mitigation. Preble’s habitat will be lost due to the construction of Glade

Reservoir. In conjunction with compensatory mitigation for impacts to wetlands and riparian habitat, the District will also develop and implement compensatory mitigation for impacts to Preble's habitat. This mitigation will occur through enhancement of existing habitat and creation of new habitat in a 143-acre area below the proposed Glade Reservoir (hereinafter referred to as the mitigation area). The District currently owns about 54 acres of this area and will purchase the remaining land, comprising about 80 acres of privately owned land and about 9 acres of State Land Board land, for Preble's habitat mitigation. An estimated 56 acres of wetlands and 33 acres of woody riparian habitat will be created in the mitigation area. Water for created wetlands and riparian habitat will be provided by seepage from the Glade Reservoir dam toe drains, and delivering water from the forebay or reservoir as a contingency source. Wetlands and Preble's habitat mitigation will be integrated, and created habitats will be seeded and planted with appropriate native wetland plants and native riparian trees and shrubs. The mitigation area includes about 54 acres of upland habitat that could provide flood refugia and winter hibernacula for Preble's. Upland habitat in the mitigation area will be enhanced through weed-control measures or, if disturbed during construction, reseeded with a native seed mix. Specific seed mixes and plant species used for Preble's habitat restoration and replacement, and the ratio of habitat lost to habitat restored, will be determined during consultation with the Service.

To avoid disturbance to Preble's or its habitat from recreational activities, public access to the mitigation area will be restricted. Disturbance to the mitigation area during dam and reservoir maintenance operations will be avoided to the extent possible. Habitat created within the mitigation area will be marked with permanent signage and maintenance workers will be instructed to minimize disturbance

in these areas. In addition, the District will work with private landowners to establish conservation easements to preserve the riparian corridor from the mitigation area to SH 14.

In its Biological Opinion (Appendix B), the Service requires the following reasonable and prudent measures for Preble's:

1. The Corps shall avoid or minimize take of Preble's through the implementation of worker education programs and well-defined operational procedures with the cooperation of a qualified biologist.
2. The Corps will require timely revegetation and enhancement of the project area to minimize the disturbance to Preble's habitat.

Terms and Conditions

The following will be implemented by the Corps and the District to meet the reasonable and prudent measures:

1. The Corps shall ensure that proposed conservation measures, as further refined by these terms and conditions, are formally adopted and implemented.
2. The Corps shall clearly define and mark the upstream and downstream limits of project disturbance as well as the lateral limits of disturbance. The Corps shall monitor the extent of habitat impacted to ensure that it does not exceed the authorized area.
3. Pipeline crossings will be constructed between November 1 and May 1 when Preble's is typically inactive.
4. Limits of disturbance will be clearly defined using barricade fencing and construction specifications that state clearly that disturbance will not occur beyond the barrier.
5. The applicants or an authorized representative shall inform workers on-site of the reason for,

and importance of, avoiding impacts to vegetated habitat outside of the fenced work areas in known and high potential habitats.

6. Work will be supervised on a daily basis to ensure that conditions established by the Service are met.
7. To the extent practicable, the pipeline under the Poudre River will be bored to avoid surface impacts to Preble's habitat.
8. The Corps shall require that temporarily disturbed areas be revegetated with native vegetation to these specifications:
 - At least 80 percent of shrubs and trees are established and growing without showing signs of stress or continued need for irrigation or fertilization.
 - Grass and wetland plants (e.g., rushes and sedges) coverage in restored areas equals at least 80 percent of comparable undisturbed areas nearby.
 - Noxious weeds will be controlled as required by the Colorado Noxious Weed Act and county guidelines and regulations.
9. The Corps shall include as a binding condition of project approval that annual monitoring of habitat restoration, revegetation, and enhancement efforts, as well as the implementation and effectiveness of such efforts, which shall include photographs, and shall gather other necessary information to determine the extent and effects of the project. Monitoring will extend for at least 3 years (or until such time as the Corps and the Service determine that the proposed revegetation has been successfully completed).
10. In the unlikely event that a Preble's mouse is encountered (dead, injured, or hibernating) during construction activities, the Colorado Field Office of the Service shall be contacted immediately at 303-263-4773.

The Corps shall provide a written report within 60 days of the completion of construction activities. This report shall contain a discussion of the activities conducted; the approximate acreage of Preble's habitat permanently and temporarily affected; any problems encountered in implementing the terms and conditions; recommendations for modifying the stipulations to enhance the conservation of Preble's; results of biological surveys and sighting records; and any other pertinent information. In addition, the Corps shall provide the Service with an annual report on the revegetation efforts after each growing season and prior to December 1 until success criteria have been met.

5.3.2 Bald Eagle

Future Monitoring. The District agrees to perform future surveys for bald eagle nests and roosts. Because bald eagles may select new nest or roost sites, potentially impacted areas will be reevaluated prior to construction for the presence of bald eagle nest and roost sites within the CDOW-recommended disturbance buffers in effect at that time.

Existing Bald Eagle Nest. The District agrees that no activities associated with pipeline construction will occur within 0.5 mile of the bald eagle nest at Greeley's Bellvue water treatment facility from November 15 through July 31. To the extent possible, construction of pipelines and other facilities associated with the Proposed Project will be avoided within ¼ mile of the nest. No cottonwoods more than 12 inches dbh within 0.5 mile of the nest will be cut during pipeline construction. Specific mitigation measures will be determined in consultation with the Service.

Delisting of Bald Eagle. The District will comply with the Bald and Golden Eagle Protection Act and any Service or CDOW guidelines to minimize impacts to bald eagles and their habitat following

removal of the bald eagle from the list of federally threatened species.

5.3.3 Colorado Butterfly Plant

The Service concurred that surveys for CBP would not be required for portions of the Glade Reservoir; U.S. 287 realignment; Glade to Horsetooth, Carter, and Cactus Hill pipelines; and SPWCP forebay and diversion study areas where no suitable habitat was found. The Service has requested that suitable CBP habitat in the Glade Reservoir and U.S. 287 realignment study areas be resurveyed for 2 years during the Fort Collins blooming period. In addition, although no known populations of CBP occur in any of the study areas, prior to construction, CBP habitat assessments and/or final surveys are recommended for potential habitat in the Poudre Valley Canal, SPWCP pipeline, and Glade to Horsetooth pipeline study areas.

If CBP is found within the construction footprint, specific conservation measures will be developed in coordination with the Service. Conservation measures could include avoiding impacts by establishing a “no-work” zone or, in the event of unavoidable impacts, protecting or enhancing adjacent or off-site habitat. Other mitigation methods include reestablishing populations in areas with suitable habitat.

5.3.4 Ute Ladies Tresses Orchid

The Service concurred that surveys for ULTO will not be required for portions of the Glade Reservoir; U.S. 287 realignment; Glade to Horsetooth, Carter, and Cactus Hill pipelines; and SPWCP forebay and diversion study areas where no suitable habitat was found. The Service has requested that suitable ULTO habitat in the Glade Reservoir and U.S. 287 realignment study areas be resurveyed for 2 years

during the Fort Collins blooming period. In addition, although no known populations of ULTO occur in any of the study areas, prior to construction, ULTO habitat assessments and/or final surveys are recommended for potential habitat in the Poudre Valley Canal, SPWCP pipeline, and Glade to Horsetooth pipeline study areas.

If ULTO is found within the construction footprint, specific conservation measures will be developed in coordination with the Service. Conservation measures could include avoiding impacts by establishing a “no-work” zone or, in the event of unavoidable impacts, protecting or enhancing adjacent or off-site habitat.

5.3.5 Platte River Target Species

All of the NISP Participants and the District will be members in good standing of South Platte Water Related Activities Program, Inc. The operation of Colorado’s Future Depletions Plan will offset new depletions to the South Platte River Basin associated with the Proposed Project and effects to the target species, whooping crane critical habitat, and other listed species in the central and lower Platte River addressed in the Programmatic Biological Opinion.

5.4 WILDLIFE

5.4.1 Coordination with CDOW

The District will coordinate with CDOW regarding the need to mitigate impacts to terrestrial wildlife and their habitat. The District will work with CDOW, Larimer County, and other interests to develop the means and support a process to protect lands in the Laramie Foothills Mountains to Plains GOCO Legacy Project. The District’s support in protection of these lands will help mitigate impacts

to native vegetation and big game winter range. The District, CDOT, and CDOW will coordinate on any needed wildlife movement mitigation for the realignment of U.S. 287 (e.g., wildlife passage structures or deer fencing).

5.4.2 Migrating Birds and Raptors

Where possible, vegetation clearing will occur during the nonbreeding period, prior to construction. If active nests are found during preconstruction surveys, they should be left undisturbed and “no-work” zones should be established around the nests until the breeding season is over. The installation of nesting deterrents to prevent nesting before April 1, and removal of these deterrents no more than 24 hours before initiation of the project, is an acceptable alternative to prohibiting construction activity during the breeding season. In cases where removal of a nest is necessary, a permit may be requested from the Service. Nesting surveys will be conducted prior to the initiation of construction activities to identify migratory bird nests in the construction right-of-way.

CDOW developed recommended buffer zones and seasonal restrictions for new surface occupancy within certain distances of nest sites of several raptor species. Surface occupancy is defined as human-occupied buildings and other structures such as oil and gas wells, roads, railroad tracks, and trails. The Service typically considers that implementation of the CDOW buffers and seasonal restrictions fulfills compliance requirements of the Migratory Bird Treaty Act (MBTA) for raptors.

A raptor nest survey will be conducted prior to project construction to identify raptor nests in the vicinity of the proposed project. If an active raptor nest is found on-site, CDOW-recommended buffers and seasonal restrictions for raptors will be

established during construction to avoid nest abandonment.

If disturbance of raptor nests is unavoidable, mitigation measures could include the construction of artificial nests in suitable habitat or enhancement of prey habitat. If raptor nests could be impacted by the proposed project, specific mitigation measures for impacts to nesting raptors will be developed in coordination with CDOW and the Service prior to construction.

5.5 CULTURAL RESOURCES

5.5.1 Programmatic Agreement

The Corps, the Colorado State Historic Preservation Officer, and the Advisory Council on Historic Preservation will enter into a Programmatic Agreement (PA). The PA will set forth how cultural resources will be addressed for NISP. Any permit from the Corps to the District will incorporate the provisions of the PA. The District and its contractors will fully follow and implement the stipulations listed on the PA (Appendix C).

5.5.2 Class III Surveys

The District will perform Class III cultural resource surveys for all facilities to be constructed for NISP. The surveys for the reservoir forebays and diversions must be completed prior to the Corps issuing a permit. Surveys for pipelines must be completed as part of final design and prior to any construction.

5.5.3 Treatment

The District will avoid properties eligible for inclusion in the NRHP through design of project facilities, relocation of project facilities, or by other

means to the extent practicable. If avoidance is not feasible or prudent, the District shall develop, in consultation with the parties to the PA, an appropriate treatment plan designed to lessen or mitigate project-related effects to the targeted historic properties. The draft treatment plan shall be submitted to the Corps by the District. For properties eligible under Criteria A through D (36 CFR Part 60.4), alternative forms of mitigation may be negotiated with the appropriate parties to the PA in lieu of, or in addition to, data recovery (e.g., monitoring, *in situ* protection, archival research).

When archeological data recovery is the preferred treatment option for an eligible property or properties, the District will develop a plan for the recovery of archeological data based on an appropriate research design. The research design shall be developed after all appropriate cultural resources inventory and evaluation work is completed. Data recovery plans shall be consistent with the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (48FR44716.37) and shall be implemented prior to any ground disturbance in the vicinity of the historic property(ies).

Discovery Situations. When cultural resources not previously identified are discovered during ground-disturbing activities, or when a previously identified historic property is affected in an unanticipated (accidental) manner, all activities within 100 feet of the discovery shall cease immediately and the District shall notify either the Corps' Field Office or the District Office. The Corps will ensure that the discovery is evaluated and recorded by a professional archeologist, as defined in the PA.

Reporting. The District will submit to the Corps an annual report by December 1 of each year the PA is in force. The annual report will summarize the actions taken the previous year under the PA.

5.6 PALEONTOLOGICAL RESOURCES

5.6.1 Coordination with CDOT

Prior to construction of the U.S. 287 realignment, the District and the Corps will coordinate with the CDOT staff paleontologist to examine the final design plans and determine the extent of bedrock impact and the scope of paleontological monitoring required.

5.6.2 Construction Monitoring of U.S. 287 Realignment

5.6.2.1 Construction Monitoring

Before the construction permit is issued by CDOT, a qualified and permitted paleontologist (Project Paleontologist) will be retained by the District to produce a project-specific mitigation plan. The Project Paleontologist and District will be responsible for implementing the mitigation measures in coordination with CDOT. This includes supervising the monitoring of construction excavations in areas with paleontological sensitivity.

The Project Paleontologist will attend preconstruction meetings to consult with the grading and excavation contractors. Language will be placed in the construction specifications stating that the Project Paleontologist will be on-site during grading or trenching operations. The construction contractor will be instructed via the written specifications and at the preconstruction meeting to stop construction if fossils, as verified by the Project Paleontologist, are unearthed. Work will cease within the vicinity of the fossils so they can be recovered and removed from the site.

All project personnel will be required to attend a Worker Awareness Training Program prior to initiation of construction activities. The Project Paleontologist will administer the paleontological resource portion of the training program. The program will educate construction personnel on the types of fossils that could be found in project excavations, their appearance, procedures to follow should they be found, and penalties for illegal collecting.

Paleontological monitoring will include inspection of exposed rock units and microscopic examination of matrix to determine if fossils are present. This work will take place during construction. Depending upon the types and significance of potential fossils, monitoring will be scheduled to take place continuously or to consist of spot checks of construction excavations. Paleontological monitors will follow earth-moving equipment and examine excavated sediments and excavation sidewalls for evidence of significant paleontological resources. The Project Paleontologist will have authority to temporarily divert grading away from exposed fossils in order to professionally and efficiently recover the fossil specimens and collect associated data. All efforts to avoid delays to construction will be made.

If microfossils are present, the Project Paleontologist will collect excavated material (matrix) for screen washing. To expedite removal of fossiliferous matrix, the Project Paleontologist may request heavy machinery assistance to move large quantities of matrix out of the path of construction to designated stockpile areas. Testing of stockpiles would consist of screen-washing small samples (approximately 200 pounds) to determine if significant fossils are present. Productive tests would result in screen-washing additional matrix from the stockpiles to a maximum of 6,000 pounds per locality to ensure recovery of a scientifically significant sample.

At each fossil locality, field data forms will be used to record the locality, measured stratigraphic sections, and appropriate scientific samples that were collected.

In the event of discovery of unanticipated fossil remains, such as unexpected concentrations of fossils, unusually large specimens, or unexpected discoveries in sediments, all ground disturbance in the area will cease immediately. The Project Paleontologist and appropriate project personnel will be notified immediately to assess the significance of the find and make further recommendations.

If any subsurface fossilized bones or other potential fossils are found by construction personnel, work in the immediate area will cease immediately, and the Project Paleontologist will be contacted immediately to evaluate the significance of the find. Once salvage or other mitigation measures (including sampling) are complete, the Project Paleontologist will notify the construction supervisor that paleontologic clearance has been granted.

The Project Paleontologist will have the authority to downgrade the monitoring effort in consultation with CDOT if the paleontological potential of the project area is found to be less than anticipated.

In the laboratory, all fossils will be prepared, identified, analyzed, and inventoried. Specimen preparation and stabilization methods will be recorded for use by the designated curation facility.

5.6.2.2 Reporting

A final paleontological monitoring report will include the results of the monitoring and mitigation program, an evaluation and analysis of the fossils collected (including an assessment of their significance, age, and geologic context), an itemized inventory of fossils collected including photographs where appropriate, an appendix of locality and specimen data with locality maps and photographs,

an appendix of curation agreements and other appropriate communications, and a copy of the project-specific paleontological monitoring and mitigation plan.

All significant fossil specimens will be transferred to an appropriate curation facility such as a public museum. The fossils will be accompanied by the final paleontological mitigation report with all data in hard and electronic copy. The fossils will be curated and permanently housed in the curation facility where they will be available for study, education, and display. The final report will be provided to CDOT, the Corps, and the District.

5.7 STREAM MORPHOLOGY

Based on an evaluation of historic data (Anderson 2008), the response of and changes to the Poudre River associated with the action alternatives are anticipated to be less than the historical morphologic changes that have occurred and continue to occur. Distinguishing the effects of NISP from current trends in river changes will likely be challenging and most effectively determined through a monitoring and adaptive management program.

For any of the action alternatives, the District will develop and initiate a monitoring and adaptive management program with a detailed inventory of each of the seven study reaches identified by Anderson Consulting Engineers (2008) and an identification of sites that will be monitored for change. Monuments will be established to collect data necessary to track changes in channel planform, bed level, and channel configuration. Vegetation transects will be established to monitor the distribution, density, and diversity of the vegetation species within and adjoining the channel. Photographic documentation will be obtained during each data collection effort. To facilitate the

compilation, review, and evaluation of the data collection efforts, a project geographical information system will be developed as an integral part of the monitoring program. A monitoring and adaptive management program will be developed by the District and submitted to the Corps for review and approval at least 2.5 years prior to NISP diversions. The inventory will be conducted by the District and presented to the Corps prior to any NISP diversions from the Poudre River, but no sooner than 2 years prior to NISP diversions. The District will continue the monitoring program beginning the year following the initiation of NISP diversions from the Poudre River and at an interval of every 5 years unless the Corps specifies a different monitoring interval or the Corps determines that monitoring is no longer necessary.

The adaptive management program will rely on the data collection efforts associated with the monitoring program. The adaptive management program is a selection of mitigation measures that can be used depending on the results of the monitoring efforts. Depending on the type, nature, and extent of the impacts, several mitigation measures may be available and will be considered to mitigate the impact. These mitigation measures may include, but are not limited to, the following:

- Accelerate establishment of channel forming by managing in-channel or riparian vegetation;
- Place structures to direct sediment to selected aggradation zones;
- Install check structures or weirs to control the inundation of riparian vegetation;
- Regulate flows and utilize exchanges to promote the increase in water level to support adjacent riparian vegetation and other river attributes;
- Install measures to reduce sediment inflow from drains or tributaries;
- Manage flows to provide flushing in selected river reaches; and

- Place measures in areas subject to bed and bank erosion.

5.8 WATER QUALITY

5.8.1 Total Organic Carbon

The District will comply with future Colorado water quality standards for total organic carbon (TOC). If TOC is not regulated by the Colorado water quality program, then 5 years prior to constructing the Glade to Horsetooth pipeline, the District will develop a plan for monitoring TOC in Horsetooth and Glade reservoirs. This plan will be submitted to the Corps and Reclamation for their review and approval.

If monitoring indicates that the delivery of water from Glade Reservoir to Horsetooth Reservoir will increase the levels of TOC in Horsetooth Reservoir to levels determined by Reclamation to be unacceptable, the District will develop a TOC mitigation plan for review and approval by the Corps and Reclamation. Mitigation of TOC levels in Horsetooth Reservoir may include treatment to reduce levels of TOC in water coming from Glade Reservoir or limiting deliveries from Glade Reservoir to Horsetooth Reservoir to times when the deliveries will not result in raising TOC levels in Horsetooth Reservoir to unacceptable levels. Reclamation will incorporate any mitigation requirements for TOC into its approval to connect the pipeline to Horsetooth Reservoir. This mitigation is limited to the effects of water deliveries from Glade Reservoir to Horsetooth Reservoir and is not intended to mitigate for any effects of TOC in Horsetooth Reservoir not associated with deliveries from Glade Reservoir.

5.8.2 Manganese and Nutrients

To prevent adverse impacts to the water quality of Horsetooth Reservoir due to delivery of water from either Glade or Cactus Hill reservoir, Glade or Cactus Hill reservoir could be operated to avoid manganese or nutrient releases from the lake bottom or by avoiding the release of deeper waters when the lake is drawn down by using a multiple outlet withdrawal structure. Water quality issues that might exist in Glade or Cactus Hill reservoir during the filling phase could be avoided in Horsetooth Reservoir by not delivering water to Horsetooth Reservoir until the water quality in Glade Reservoir or Cactus Hill Reservoir reaches its long-term equilibrium.

5.8.3 Temperature and Dissolved Oxygen

Releases from Glade Reservoir to the Poudre River will occur within a segment of the Poudre River designated by CDOW and CDPHE to be a coldwater fishery. It is not anticipated that releases from Glade Reservoir will need multiple depth options to control the temperature of the releases because the water will be released to a coldwater segment. During the late spring and summer months when the largest amounts of water would be withdrawn from the river, stream temperature could be monitored on a continuous basis in the river. NISP diversions could be reduced or limited to the cooler portion of the day (midnight to 9:00 a.m.) when the stream temperature exceeds the 20°C temperature standard on an average daily basis for more than several days. Alternatively, the District could implement the planting of riparian trees that could shade and cool affected reaches of the Poudre River. To control adverse impacts to the temperature of the Poudre River, the District will implement, to the Corps' satisfaction, the means to mitigate any significant

adverse effects of Glade Reservoir releases on the temperatures of the Poudre River. Discharge to the Glade forebay and the Poudre River will be fully aerated by the energy dissipation structures.

5.8.4 Stormwater Management Plan

The District will implement a construction stormwater management plan (SWMP). The SWMP will be developed in accordance with the State of Colorado Water Quality Program. A plan, application, and permit will be developed and acquired pursuant to the requirements and guidance of the CDPHE. The application will include the required construction dewatering discharge permits, downstream user notifications, and onsite documentation. The permit may require water testing on a specified schedule for water discharges during construction. A complete erosion- and sediment-control program overseen by a professional SWMP consultant will be administered for the Project.

BMPs such as silt fencing will be established and maintained to minimize sediment from reaching wetlands and waters that will not be filled. The fencing will also serve to delineate the limits of project disturbance.

5.9 TRAFFIC AND TRANSPORTATION

5.9.1 Relocation of U.S. 287

The District has committed to work with CDOT on the relocation of U.S. 287 if the Proposed Action is permitted. The District commits to the following regarding its coordination with CDOT on the relocation of U.S. 287:

- Final design will follow the design configuration and criteria as outlined in the U.S. 287 Relocation Study (Muller 2007).
- All property acquisition will follow the CDOT Right of Way Manual and the Federal Uniform Relocation and Real Property Acquisition Act. CDOT oversight and coordination will be required during this process.
- The final design of the highway will be done with CDOT oversight. Design shall meet all applicable CDOT, AASHTO, and Larimer County requirements. A Project Scoping meeting, Field Inspection Review and Final Office Review will be conducted following CDOT procedures.
- Final Plan, Specification and Estimate approval along with environmental clearance, ROW clearance, and utility clearance will be obtained from CDOT prior to advertisement of the project for construction.
- CDOT and the District will prepare IGAs to address Preconstruction, Construction, Ownership, and Maintenance responsibilities.
- The District will coordinate with utility companies on the design and relocation of impacted facilities.
- The District will conduct a detailed geotechnical and pavement study for the final design.
- The District will conduct a slope stability, landslide evaluation and rockfall study for the hogback cut area if the western alignment is selected. The preliminary design of the rock cut may be modified to accommodate rock fall and snow storage requirements.
- In order to mitigate potential icing and blowing snow conditions on the roadway at the hogback cut (western alignment), the use of ITS technologies, including variable message signs, pavement sensors, video monitoring and weather station technologies will be considered. Dynamic speed limits correlated to roadway conditions, communicated through the variable message signs will also be considered.
- Following construction, the rock cut area (western alignment) will be monitored with regard to icing and blowing snow conditions and

appropriate mitigation, should it become necessary, would be designed and implemented based upon in-place field conditions.

5.9.2 Glade Reservoir

The current CSU access road to the Poudre River State Trust land, the Bonner Spring Ranch Road, and Big Ridge Way would be affected by the placement of Glade Reservoir and/or the realignment of U.S. 287. If an alternative involving Glade Reservoir is permitted, the District commits to provide comparable alternative access to the Poudre River State Trust land for CSU and for users of the Bonner Spring Ranch Road and Big Ridge Way.

5.9.3 Cactus Hill Reservoir

If an alternative involving Cactus Hill Reservoir is permitted, several Weld County roads would be inundated and would require realignment. The District commits to the following for any alternative involving Cactus Hill Reservoir that is permitted:

- Coordinate with Weld County to ensure that the required road relocations meet all Weld County requirements.
- Perform or fund a traffic impact study as part of the design of the road relocations.
- Obtain any needed authorizations from Weld County for access to the Cactus Hill Reservoir facility from the existing roadway networks.

5.10 TCE PLUME AT GLADE RESERVOIR FOREBAY

Although TCE has not been detected at levels above the Colorado ground water standards in ground water beneath the northwestern corner of the proposed forebay, seasonal sampling has not been conducted to determine accurate fluctuations in TCE

concentrations and ground water depths. Based on potential uncertainty in TCE concentrations and ground water elevations, the District and the Corps agree to the following if Alternative 2 is authorized:

- Proposed construction designs for the forebay will include an impermeable lining along the walls and bottom of the forebay to eliminate seepage losses/gains during operation of the forebay.
- Well abandonment will occur in accordance with the regulations of the Colorado Division of Water Resources for the monitoring wells within the forebay construction area prior to excavation activities to assure there is no potential pathway for TCE contamination.
- Following Colorado Hazardous Waste Regulations, saturated soils encountered during excavation activities will be managed as hazardous waste (i.e., stored in tanks or containers) until the CDPHE issues a determination whether the resultant mixture (i.e., soil and ground water containing an F-listed waste) no longer contains a hazardous waste.
- If ground water is encountered during construction activities within the northwestern corner of the forebay, the ground water will be containerized and tested for TCE prior to disposal or use. If the recovered ground water contains TCE in excess of the Colorado ground water standards, the containerized water will be disposed of as hazardous waste or, after approval from the CDPHE, treated under the permit-by-rule provisions of Section 100.21(d) of the Colorado Hazardous Waste Regulations to concentrations that would allow a nonhazardous waste determination.
- Ground water encountered during excavation activities within the southeastern corner of the forebay will be periodically tested for the presence of TCE to ensure proper disposal and worker health and safety.
- If used, water wells for construction water supply will not be screened within the TCE plume area.

The Corps and the District will develop an agreement prior to construction of the forebay that determines the respective responsibilities of the Corps and District for implementing these mitigative measures.

5.11 VISUAL RESOURCES

5.11.1 Mitigation of Short-term Effects

The District will implement the following mitigation measures to reduce impacts on visual resources during construction for any of the action alternatives:

- Institute dust-control procedures throughout the construction process.
- Locate staging areas and equipment and material storage facilities at or near sites either mostly or completely obscured from a majority of the observation points (OPs) and homes with views of the dam and/or reservoir alternatives.

5.11.2 Mitigation of Long-term Effects

For all action alternatives, the dam and reservoir would alter views from some locations in the project area. The District agrees to implement the following mitigation measures to minimize the contrasts and decrease the visibility between the proposed dam and the OPs for any action alternative:

- Revegetate all disturbed areas by seeding and/or planting with native plant species existing at this site. Prior to construction, develop a landscape planting plan to effectively select and locate proposed plant materials to enhance or screen views of the reservoir and/or dam.
- Shape cut slope faces to blend with adjacent undisturbed rock faces.

- Connect new fills associated with the dam to adjacent undisturbed slopes by developing similar landforms and drainage patterns.
- Plant native tree and shrub species in selected locations to obscure views of the proposed dam from the most visually affected OPs.

5.11.3 U.S. 287 Realignment Alternatives

The District has committed to work with CDOT on the relocation of U.S. 287 if the Proposed Action is permitted (Section 5.9). The District will work with CDOT to minimize adverse visual effects of the road.

For both realignment alternatives, the road would alter views of some locations in the project area. The following mitigation measures will be pursued with CDOT to minimize the contrasts between the road and its surroundings.

5.11.3.1 Soil Cuts

- Smoothly transition the upper 10 feet of cut face into undisturbed ground by rounding to diminish visible edges.
- Preserve existing rock outcrops outside of clear zone and within construction limits to vary cut face slope, composition, color, and texture. Undulate or roughen cut face to match existing land shapes.
- Preserve selected existing individual trees and/or shrubs outside clear zone and within construction limits for the same reasons stated above.
- For placement of surface stones, use only stones salvaged from the ground surface prior to construction.
- Revegetate by seeding and/or planting with native plants.
- Dry-lay stone boulders at the clear zone edge to retain low height soil cut slopes (< 5 feet) in appropriate locations with existing surface boulders or rock outcrops.

- Shape cut slope faces to blend with adjacent undisturbed slopes.

5.11.3.2 Rock Cuts

- Manipulate blasting patterns to create rock surfaces, terraces, and ridges similar to undisturbed rock faces and outcrops.
- Shape cut faces to blend with adjacent undisturbed rock faces.
- Create soil pockets within the terraces and ridges of cut faces to accommodate and promote revegetation at appropriate locations. Locate, size, and shape soil pockets to replicate the planting areas of undisturbed rock faces.

5.11.3.3 Fills

- Combine terracing, surface stone placement, and revegetation similar to adjacent undisturbed ground surfaces and land forms.
- Construct new fill slopes using terraces, native stones, and native plants. The size, shape, and location of terraces should be similar to the adjacent undisturbed landforms. The density and placement of stones and plants also should be similar to the density and placement of adjacent undisturbed stones and plants.
- Connect new fills to adjacent undisturbed slopes by developing similar landforms and drainage patterns.
- Revegetate by seeding and/or planting with native species.

5.11.3.4 Retaining Walls

- Treat exposed and visible concrete retaining wall faces and tops with form liners or stone facing to be similar to undisturbed rock outcrop surfaces.
- Treat mechanically stabilized earth wall face and tops with pre-cast concrete panels or dry-laid stone. Pre-cast panels should be complimentary to undisturbed rock outcrop surfaces.

5.12 AIR QUALITY

To minimize and control fugitive dust, the District will develop and implement a fugitive particulate emission control plan that identifies specific steps that will be taken to minimize fugitive dust generation.

5.13 SOCIOECONOMICS

5.13.1 SPWCP Exchanges

The exchange of water from the SPWCP to the Larimer-Weld and New Cache canals for Poudre River water diverted under the Grey Mountain water right will increase the salinity of irrigation water, which could affect crop yields. The District will compensate irrigators for reduced crop yields as part of the agreements with the irrigation companies that participate in the exchanges.

5.14 BEST MANAGEMENT PRACTICES

The District commits to implementing the following BMPs for construction of facilities associated with any action alternative. The following BMPs will help avoid and minimize impacts to the environment:

- The clearing of vegetation will be limited to that which is necessary for the construction of the project.
- All dredged or excavated materials, with the exception of those authorized, will be placed on an upland site above the OHWM in a confined area that is not classified as a wetland to prevent the return of such materials to the waterway.
- Deposition of excavated materials on shore and all earthwork operations on shore will be carried out in such a way that sediment runoff and soil erosion into the water is avoided. A soil-

sediment-, and erosion-control plan will be implemented.

- All construction debris (which includes excess dredge and/or fill materials, wood, cleared vegetation, concrete, and all other materials not specifically addressed in the permit) will be disposed of on land in such a manner that it cannot enter a waterway or wetland.
- Equipment for handling, conveying, and discharging materials during construction will be operated to prevent dumping or spilling the materials into wetlands and waters. Use of the machinery in waterways would be kept to a minimum. All work in waterways will be performed in such a manner to minimize increases in suspended solids and turbidity that may degrade water quality and damage aquatic life outside the immediate area of operation.
- Concrete trucks will be washed at a site and in such a manner that wash water cannot enter any wetland or waterway. Measures also will be employed to prevent wet concrete from entering any waterway.
- Only clean rock material from a nonstreambed source will be used for riprap in order to avoid the introduction of fines, which will result in excessive local turbidity.
- All areas along the banks that would be disturbed or newly created by the construction activity (and are not to be riprapped), will be seeded and planted with vegetation indigenous to the area. This vegetation will include both herbaceous and woody species. These areas may require periodic maintenance, such as reseeding, replanting, watering, implementation of grazing restrictions, fencing, and noxious weed control, to ensure survival of revegetated areas. Riprapped areas, except for soil riprap, will not be further disturbed through vegetation-control techniques.
- Measures will be employed prior to initiation of construction to prevent or control spilled petroleum products, chemicals, or other deleterious material from entering the water.
- A contingency plan will be formulated to be effective in the event of a spill.
- Aboveground fuel storage tanks will be diked or curbed, or contained by other suitable means, to prevent the spread of liquids in case of leakage in the tanks or piping.
- Fill created by the discharges will be properly maintained to prevent erosion and other nonpoint sources of pollution.
- Silt fencing or other types of construction fencing will be placed between the construction zone and existing (not to be disturbed) wetlands to prevent unauthorized impacts to wetlands.

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Chapter 6

Public Participation

6.1 PUBLIC PARTICIPATION SUMMARY

6.1.1 Public Scoping

As required by NEPA, the Corps has provided for an early and open process to determine the scope of significant issues to be addressed in the EIS. Scoping is not a single isolated action, but an ongoing process. The scoping process helps to:

- Inform the public and the affected agencies about the background, purpose, and features of the proposed project
- Objectively identify public issues and concerns about the Proposed Action
- Gather additional information about the issues
- Identify a reasonable range of alternatives and potential impacts to be addressed

To identify the issues and concerns related to NISP, agency and public scoping was undertaken by the Corps as follows.

6.1.1.1 Public Scoping Outreach Activities

Public scoping outreach activities included publication of a Notice of Intent (NOI) in the Federal Register, paid advertisements announcing public scoping meetings, a scoping announcement, and publication of Project information on the District's website and the Corps' website. These

activities are described in the NISP Scoping Report (ERO 2005a).

The Corps held three public scoping meetings to solicit ideas, issues, and concerns about the proposed Project. One meeting was held in Eaton on September 20, 2004; one was held in Fort Collins on September 21, 2004; and one was held in Laporte on September 22, 2004.

Each scoping meeting was in an open house format. Representatives from the Corps, the District, and ERO and HDR Engineering, Inc. (both the Corps' EIS consultants) were present to answer questions. In addition, CDOT representatives were present at the Fort Collins and Laporte public meetings to respond to questions regarding the proposed reroute of U.S. 287. Comment sheets to encourage written comments were provided at each public meeting. The Fort Collins and Laporte public meetings included a question and answer session hosted by the Corps. Questions or comments posed during the question and answer sessions were recorded on easels.

6.1.1.2 Agency Scoping Meeting

On September 21, 2004, the District hosted an agency scoping meeting from 10:00 a.m. to 5:00 p.m. Letters were sent to 13 local, state, and federal agencies inviting them to attend the meeting. The format of the agency scoping meeting was an introduction by the Corps followed by a slide show presentation of the District's Proposed Action, and a question and comment period facilitated by the Corps. Agency representatives then toured the sites included in the District's Proposed Action.

Twenty-two members from various agencies and organizations attended the agency meeting. The following agencies and organizations were represented:

- U.S. Fish and Wildlife Service

- Colorado Department of Transportation
- Bureau of Land Management
- Bureau of Reclamation
- Environmental Protection Agency
- Colorado Division of Wildlife
- Colorado Department of Public Health and Environment/Water Quality Control Division
- Colorado Office of Archeology and Historic Preservation
- Colorado State Land Board
- Larimer County

The NISP Scoping Report (ERO 2005a) contains a summary of the outreach activities, public and agency scoping meetings, and a summary of comments received from the public and agencies.

6.1.1.3 U.S. 287 Public Open House Meeting

The Corps and CDOT held a public open house meeting on March 30, 2005 at the American Legion Post near Laporte, Colorado. The public open house was held to inform the public about the alternatives under consideration for the potential U.S. 287 realignment associated with some of the NISP alternatives. The Corps provided several descriptive handouts and informational posters. Representatives from the Corps, CDOT, the District, ERO, and HDR Engineering, Inc., were present to answer questions. Comment sheets were provided at the public open house meeting to encourage written comments. The public open house meeting was attended by more than 100 people. A summary of this meeting is included in the U.S. 287 Realignment Public Open House summary document (ERO 2005d).

6.1.1.4 Future Planned Outreach Activities

Public hearings will be held after issuing the Draft EIS. The time, date, and location of future opportunities for comment will be mailed to those on the Corps' NISP mailing list and posted on the District's website and the Corps' website. The Corps welcomes all comments during the EIS process. For information and updates about the planning process, please visit the Corps' website (<http://www.nwo.usace.army.mil/html/od-tl/eis-info.htm>) or the Project website (http://www.ncwcd.org/project&features/nisp_main.asp). Periodic newsletters providing updates on the NISP EIS will be sent to those on the mailing list and will be posted

on both websites. Anyone interested may request a copy of the newsletters.

6.2 CONSULTATION AND COORDINATION

Table 6-1 lists the government agencies, businesses, organizations, and individuals contacted or consulted during the preparation of the Draft and Final EISs. Technical input regarding the project was provided by the District and its consultants.

Table 6-1. List of Agencies and Organizations Contacted for the Draft EIS.

Organization Name
Federal Agencies
<ul style="list-style-type: none"> • U.S. Army Corps of Engineers – Omaha District • U.S. Fish and Wildlife Service (USFWS) • Bureau of Land Management (BLM) • U.S. Forest Service • Bureau of Reclamation (Reclamation) • Environmental Protection Agency (EPA) • National Park Service (NPS)
State Agencies
<ul style="list-style-type: none"> • Colorado Division of Wildlife (CDOW) • Colorado Department of Transportation (CDOT) • Colorado Department of Public Health and Environment (CDPHE)/Water Quality Control Division (WQCD) • Colorado State Historic Preservation Officer (SHPO), Colorado Office of Archaeology and Historic Preservation (OAH) • Colorado State Land Board • Colorado State University • Colorado State Parks
Local Agencies and Special Districts
<i>Larimer County</i> <ul style="list-style-type: none"> • Parks and Open Lands • Department of Road and Bridge <i>Weld County</i> <ul style="list-style-type: none"> • Planning and Zoning Department <i>Boulder County</i> <ul style="list-style-type: none"> • Planning and Zoning Department <i>Morgan County</i> <ul style="list-style-type: none"> • Planning and Zoning Department <i>City of Fort Collins</i> <ul style="list-style-type: none"> • Department of Natural Resources • Parks Planning and Development Division

Organization Name

- Community Planning Department
- Geographic Information Services
- Current Planning Department
- Utilities Department
- Fort Collins Museum

City of Greeley

- Parks Department
- Planning Department
- Water and Sewer Department
- Greeley Museums

Town of Timnath

- Planning Department

Town of Windsor

- Planning Department
- Parks Department

Town of Erie

- Town Administrator

City of Fort Lupton

City of Fort Morgan

City of Lafayette

City of Longmont

Town of Ault

Town of Berthoud

Town of Brush

Town of Dacono

Town of Eaton

Town of Erie

Town of Estes Park

Town of Evans

Town of Firestone

Town of Frederick

Town of Gilcrest

Town of Hillrose

Town of Hudson

Town of Johnstown

Town of Keenesburg

Town of Kersey

Town of LaSalle

Town of Lyons

Town of Mead

Town of Milliken

Town of Nunn

Town of Pierce

Town of Platteville

Town of Severance

Town of Wellington

Town of Windsor

Left Hand Water District

Organization Name	
Local Businesses	
<ul style="list-style-type: none"> • A-1 Wildwater • Rocky Mountain Adventures • A Wanderlust Adventure • The Mountain Shop 	
Local Organizations	
<ul style="list-style-type: none"> • Friends of the Poudre • Poudre Paddlers • American Historical Society of Germans From Russia - Northern Colorado Chapter • Fort Vasquez • The St. Vrain Historical Society, Inc. • Legacy Land Trust • Poudre Landmarks Foundation, Inc. • Boulder County Historic Prehistoric Advisory Board • Fort Morgan Museum • Save the Poudre Coalition 	
Industry Consultants	
<ul style="list-style-type: none"> • HDR Engineering • BBC • CEC/ GEI Consultants • Muller Engineering • Rocky Mountain Paleontology • Holdeman Landscape Architecture • Western Cultural Resource Management • Corona Research 	
Native American Tribes	
<ul style="list-style-type: none"> • Apache Tribe of Oklahoma • Assiniboine & Sioux Tribes of Ft. Peck • Blackfeet Tribe • Cheyenne-Arapaho Tribes of Oklahoma • Cheyenne River Sioux Tribe • Chippewa Cree Tribe of the Rocky Boys' Reservation • Comanche Nation • Comanche Tribe of Oklahoma • Confederated Salish and Kootenai Tribes • Crow Creek Sioux Tribe • Crow Nation • Eastern Shoshone Tribe • Flandreau Santee Sioux Tribe • Fort Sill Apache Business Committee • Gros Ventre and Assiniboine Tribe of Ft. Belknap • Iowa Tribe of Kansas and Nebraska • Iowa Tribe of Oklahoma • Jicarilla Apache Tribe • Kickapoo Tribe in Kansas • Kiowa Indian Tribe of Oklahoma • Lower Brule Sioux Tribe • Mni Sose Intertribal Water Rights Coalition • Northern Arapaho Tribe • Northern Cheyenne Tribal Council • Northern Ute Tribal Uintah and Ouray Tribal Business Committee • Oglala Sioux Tribe 	

Organization Name

- Omaha Tribe of Nebraska
- Otoe-Missouria Tribal Council
- Pawnee Nation of Oklahoma
- Ponca Tribe of Nebraska
- Ponca Tribe of Oklahoma
- Prairie Band of Potawatomi Nation
- Rosebud Sioux Tribe
- Sac and Fox Nation
- Sac and Fox Tribe of the Mississippi in Iowa
- Sac and Fox Nation of Missouri, Kansas, and Nebraska
- Santee Sioux Nation
- Sisseton-Wahpeton Sioux Tribe
- Southern Ute Indian Tribe
- Spirit Lake Sioux Tribe
- Standing Rock Sioux Tribe
- Three Affiliated Tribes
- Trenton Indian Service Area
- Turtle Mountain Band of Chippewa
- Ute Mountain Tribe
- Winnebago Tribe of Nebraska
- Yankton Sioux Tribe

6.3 OTHER PERMITS AND APPROVALS

construction of the District's Proposed Action would likely require a variety of permits and approvals from the state and local government (Table 6-2).

In addition to the required federal authorization and actions described in Sections 1.1.1 and 1.11,

Table 6-2. State and Local Permits and Approvals Likely Required to Construct and Operate NISP.

Permit/Approval	Purpose	Project Component
State of Colorado		
Colorado State Engineer's Office, Division of Water Resources Permit to Construct Facility (Dam) Reservoir Storage Permit Dam Safety Permit	Authorizes dam and reservoir construction and reviews dam safety.	Dam and reservoir construction and operation for Glade and Galeton reservoirs.
Department of Public Health and Environment, Air Pollution Control Division Land Development Permit (Fugitive Dust Control Plan)	Protects air quality from dust and airborne particulates resulting from construction activities of more than 25 acres in size or 6 months in duration.	All ground-disturbing construction activities for reservoirs and U.S. 287 realignment.

Permit/Approval	Purpose	Project Component
Department of Public Health and Environment, Water Quality Control Division General Permit for Stormwater Discharges Associated with Construction Activity Section 401 Water Quality Certification	Controls the discharge of stormwater pollutants associated with construction activities. To ensure that activities authorized under Section 404 meet state water quality standards and do not degrade water quality.	All ground-disturbing construction activities disturbing more than 5 acres. All activities subject to the Section 404 permit from the Corps.
Construction Dewatering Permit Colorado Department of Transportation Access Permit Colorado Division of Wildlife SB-40 Certification	To ensure that dewatering of ground water from a construction site does not impair the receiving waters. To ensure access meets state and federal highway standards. To ensure that impacts to aquatic habitat and riparian resources are adequately addressed.	Dewatering during excavation and placement of fill for the dams, forebays, and pipelines. Access to Glade Reservoir from SH 14. Stream crossings by the U.S. 287 realignment.
Larimer County		
Location and Extent Review	To ensure that the proposed development is consistent with the Larimer County master plan.	Glade Reservoir and associated facilities.
Fugitive Dust Permit	Protects air quality from dust and airborne particulates associated with construction.	Glade Reservoir and associated facilities.
Flood Plain Development Permit	To ensure that facilities will not adversely alter floodplain capacity.	All facilities and development within the 100-year floodplain.
Grading Permit	Authorizes ground-disturbing construction.	All facilities in Larimer County.

Permit/Approval	Purpose	Project Component
Weld County		
Use By Special Review	To ensure that the proposed development is consistent with the Weld County master plan.	Galeton Reservoir and SPWCP.
Grading Permit	Authorizes ground-disturbing construction.	All facilities in Weld County.

6.4 PREPARERS AND CONTRIBUTORS

The NISP EIS was prepared by ERO, a third-party contractor, working under the direction of and in cooperation with the U.S. Army Corps of Engineers,

Omaha District, the lead federal agency. HDR Engineering, Inc. was responsible for the hydrologic modeling. Table 6-3 provides the names and organizations of the individuals who were principally involved with preparing the EIS.

Table 6-3. List of EIS Preparers and Contributors.

Name/Title	Responsibilities	Education	Experience
U.S. Army Corps of Engineers			
Chandler Peter	Project Manager NEPA/EIS 404(b)(1) Coordinator	B.S. Biology	20 years
Northern Colorado Water Conservancy District			
Carl Brouwer	Project Manager	M.S. Civil Engineering – Water Resources Planning and Management B.S. Civil Engineering	21 years
Don Carlson	Assistant General Manager	B.S. Agricultural Engineering M.S. Environmental Engineering	34 years
Andy Pineda Senior Water Resources Engineer	Water Resources	B.S. Agricultural Engineering	27 years
Brian Werner	Public Information Officer	M.A. History B.A. History	25 years
Nicole Seltzer Public Affairs Coordinator	Public & Media Relations	M.S. Water Resources B.A. Environmental Studies	7 years

Name/Title	Responsibilities	Education	Experience
ERO Resources Corporation			
Steve Dougherty Senior Ecologist	Project Manager	M.S. Environmental Science B.S. Biology	30 years
Liz Payson Tucker Senior Plant Ecologist	Assistant Project Manager, Vegetation	M.S. Biological Sciences B.S. English Literature	15 years
Karen Baud Wildlife Biologist	Wildlife and Species of Concern	M.A. Biology B.A. Biology	9 years
Kay Wall Technical Editor	Technical Editor	A.A. Microsoft Office 2003 Specialist	25 years
Marty Clark Technical Editor	Technical Editor	B.A. English	20 years
Brian Olmsted Geochemist	Hazardous Sites and TCE Plume	M.S. Geochemistry B.S. Geology	5 years
Barbara Galloway Senior Hydrologist	Water Quality, Water Resources, and Stream Morphology	M.S. Water Resources B.A. Biology and Environmental Conservation	21 years
Michael Galloway Senior Hydrogeologist	Ground Water	M.S. Geology B.S. Geology	36 years
Denise Larson Ecologist	Wetlands	M.A. Biology and Plant Ecology B.A. Biology	14 years
David Hesker Graphic Designer	Graphic Design	B.A. Fine Arts	16 years
Jana Pedersen GIS Specialist	GIS and Maps	B.S. Geosciences	5 years
Clint Henke Natural Resource Specialist	Wetland and Wildlife Field Surveys	M.S. Environmental Sciences B.S. Biology	6 years
Ron Beane Wildlife Biologist	Wildlife Field Surveys and Technical Peer Review	M.A. Biology B.S. Wildlife Biology	27 years
Stacey Antilla, Natural Resource Planner	Assistant Project Manager Recreation and Land Use	M.S. Recreation Resources B.S. Biology	6 years
Sean Larmore Senior Archaeologist	Cultural Resources	M.A. Anthropology B.A. Anthropology	11 years

Name/Title	Responsibilities	Education	Experience
Sadie Russo Natural Resource Specialist	Wetland Surveys and GIS	B.S. Natural Resource Management	7 years
HDR Engineering, Inc.			
Seth Turner Water Resources PE	Water Resources	M.S. Civil Engineering B.S. Agricultural Engineering	5 years
Jerry Kenny Water Resources Section Manager- Colorado/National Technical Advisor on Water Supply Planning	Task Leader	Ph.D. Engineering M.S. Engineering B.S. Civil Engineering	30 years
George Oamek	Socioeconomics	Ph.D. Agricultural Economics M.S. Agricultural Economics B.S. Agricultural Economics	25 years
Kristen Gibbs Economist	Socioeconomics	B.S. Agricultural Economics	4 years
Courtney Reuer Project Engineer	Water Resources	B.S. Civil Engineering	5 Years
Mary Kay Provaznik	Water Resources	M.S. Civil Engineering M.B.A. B.S. Civil Engineering	12 years
Rebecca Mitchell Water Resources Engineer	Water Quality	B.S. Engineering	5 years
Karen Creamer Project Manager/ Engineer	Traffic and Transportation	B.S. Civil Engineering	13 Years
Doug Emmons Roadway Engineer	Traffic and Transportation	B.S. Civil Engineering	26 years
Muller Engineering			
Gray Clark	U.S. 287 Relocation	M.B.A. B.S. Civil Engineering	20 years

Name/Title	Responsibilities	Education	Experience
Rocky Mountain Paleontology			
Paul Murphey	Paleontological Resources	Ph.D. Paleontology M.S. Geological Sciences (Paleontology) B.A. Anthropology/ Biology	15 years
Colorado Department of Transportation			
Carol Parr	Region 4 Coordinator	M.N.S. Biology B.S. Biology	25 years
Holdeman Landscape Architecture, Inc.			
Mark Holdeman Landscape Architect	Visual Resources	B.A. Landscape Architecture Registered Landscape Architect in Kansas, New Mexico, and Wyoming	25 years
BBC			
Douglas Jeavons	Socioeconomics	M.A. Economics B.A. International Affairs	17 years
Janet Clements	Socioeconomics	M.S. Agricultural Economics B.S. Sustainable Resource Management	4 years
Trout, Raley, Montaña, Witwer & Freeman, P.C.			
Peggy E. Montaña	Legal	B.A. Political Science J.D. University of Colorado	27 years
CEC/GEI			
Don Conklin Aquatic Ecologist	Aquatics Resources	B.S. Biology M.S. Water Resources Management	25 years
Western Cultural Resource Management			
Tom Lennon	Cultural Resources	Ph.D. Anthropology M.S. Anthropology M.S. Corporate Communications B.A. History	34 years
Steve Mehls	Cultural Resources	Ph.D. History of Western U.S. M.A. U.S. History B.A. History	29 years

Name/Title	Responsibilities	Education	Experience
Collette Chambellan	Cultural Resources	M.A. Anthropology B.A. Anthropology	33 years

Chapter 7

References

- AASHTO. 2004. Guide for the Geometric Design of Highways and Streets.
- Agriculture, Economic Statistics and Market Information System. 2004.
- Anderson Consulting Engineers, Inc. (Anderson). 2008. Northern Integrated Supply Project Environmental Impact Statement River Morphology and Sediment Transport Technical Report for the Cache la Poudre River. Prepared for the U.S. Army Corps of Engineers. March.
- Andrews, R. and R. Righter. 1992. Colorado Birds. Denver Museum of Natural History. Denver, Colorado.
- Anheuser-Busch Companies Environmental, Health, & Safety Report. 2004. Available at: [http://www.abehsreport.com/docs/ABI-EHS site 2004.pdf](http://www.abehsreport.com/docs/ABI-EHS%20site%202004.pdf).
- Bachand, R. 2006. City of Fort Collins Senior Environmental Planner. Personal communication with K. Baud, ERO Resources Corporation. November 3.
- Bauder, T. A., R. M. Waskom, and J. G. Davis. 2004 (Reviewed). Irrigation Water Quality Criteria. Colorado State University Cooperative Extension, Crop Series – Irrigation, No. 0.506. Available at: <http://www.ext.colostate.edu/pubs/crops/00506.html>. Accessed July 28, 2006.
- BBC (BBC Research and Consulting). 2005. Memorandum RE: Review of Harvey Economics Report: Water Supply and Demands for Participants in the Northern Integrated Supply Project. Prepared for the U.S. Army Corps of Engineers Omaha District.

- BBC Research and Consulting. NISP Participant Water Rates and System Development Fees, 2006.
- Bestgen, K. R. and K. D. Fausch. 1993. *Status and trends of the fish community at ten sites in the Cache la Poudre River, from Fort Collins to Greeley, Colorado, 1970-1992*. Department of Fishery and Wildlife Biology, Colorado State University, Fort Collins, CO.
- Bibles, B. 2006. Colorado Division of Wildlife Raptor Biologist. Personal communication with R. Beane, ERO Resources Corporation. February 24.
- Boaz, B. 2006. Bureau of Reclamation. Personal communication with Steve Dougherty, ERO Resources Corporation, July 13.
- Bode, D. 2006. Water Resources Manager, Fort Collins. Personal communication with Karen Baud, Biologist, ERO Resources Corporation. June 22.
- Boulder County Land Use Department. 2006. "Boulder County Population 1940 -2000" website table, accessed June 2006.
- Boulder County Parks and Open Space Department. 2006. About Boulder County Parks and Open Space. Website: www.co.boulder.co.us/openspace. Accessed June 2006.
- Boulder County. 1999. Boulder County Comprehensive Plan. Available at: <http://www.co.boulder.co.us/lu/bccp/>. Accessed August 30.
- Boulder County. 2000. Boulder County Growth Watch. Issue 3, Winter 2000. Available at: http://www.co.boulder.co.us/lu/growthwatch/pdf/growthwatch_2000.pdf.
- Bovee, K. D. 1982. A guide to stream habitat using the Instream Flow Incremental Methodology. Instream Flow Information Paper: No. 12. FWS/OBS-82/26. U S Department of the Interior, Fish and Wildlife Service.
- Braddock, W. A. and J. C. Cole. 1978. Preliminary Geologic Map of the Greeley 1° x 2° Quadrangle, Colorado and Wyoming. U.S. Geological Survey Open File Report 78-532 (scale 1:250,000).
- Braddock, W. A., J. J. Connor, G. A. Swann, and D. D. Wohlford. 1988a. Geologic map of the Laporte Quadrangle, Larimer County, Colorado: U.S. Geological Survey Map GQ-1621 (scale 1:24,000).
- Braddock, W. A., J. J. Connor, G. A. Swann, and D. D. Wohlford. 1988. Geologic map of the Laporte Quadrangle, Larimer County, Colorado: U.S. Geological Survey Map GQ-1621 (scale 1:24,000).
- Braddock, W. A., P. Nutalay, and R. B. Colton. 1988. Geologic map of the Carter Lake Quadrangle, Larimer County, Colorado: U.S. Geological Survey Map GQ-1628 (scale 1:24,000).
- Braddock, W. A., P. Nutalay, and R. B. Colton. 1988b. Geologic map of the Carter Lake Quadrangle, Larimer County, Colorado: U.S. Geological Survey Map GQ-1628 (scale 1:24,000).
- Braddock, W. A., R. H. Calvert, J. T. O'Connor, and G. A. Swann. 1989. Geologic map of the Horsetooth Reservoir Quadrangle, Larimer County, Colorado: U.S. Geological Survey Map GQ-1625 (scale 1:24,000).
- Braddock, W. A., R. H. Calvert, S. J. Gawarecki, and P. Nutalay. 1970. Geologic map of the Masonville Quadrangle, Larimer County, Colorado: U.S. Geological Survey Map GQ-832 (scale 1:24,000).
- Brouwer, C. 2008. Memo to Steve Dougherty, ERO Resources Corporation, and Chandler Peter, U.S. Army Corps of Engineers, on Drought Operational Flexibility for NISP. February 7.
- Bryant, B., L. McGrew, and R. A. Wobus. 1981. Geologic map of the Denver 1° X 2° Quadrangle, north-central Colorado: U.S. Geological Survey Miscellaneous Investigations Map, I-1163, 2 sheets (scale 1:250,000).
- Bureau of Economic Analysis, consumer price index 1999 to 2005.

- Bureau of Reclamation (Reclamation). 2006. U.S. Bureau of Reclamation website – Great Plains Region. Horsetooth Reservoir Description. Available at: http://www.usbr.gov/gp-bin/arcweb_htoothr.pl. Accessed June 14, 2006.
- Carter Lake Sailing Club. 2006. Available at: <http://www.sailcarter.org/cgi-bin/static.pl?page=about>. Accessed on July 21, 2006.
- Cattanéo, F., N. Lamouroux, P. Briel, and H. Capra. 2002. The influence of hydrological and biotic processes on brown trout (*Salmo trutta*) population dynamics. *Canadian Journal of Fisheries and Aquatic Sciences* 59:12-22.
- CDM. 2005. Statewide Water Supply Initiative, Executive Summary, Page ES-9.
- CDOT. 2007. Available at: <http://www.dot.state.co.us/northI25eis/schedule.cfm> Website last accessed on: October 16.
- CDOW. 2005.
- CDOW. 2006.
- Chadwick, J. W., L. C. Bergstedt, D. J. Conklin, and S. P. Canton. 2004. Drought and trout - sometimes less is more. Pages 1-13. IN: de Carvahlo Freitas, C. E., M. Petreire, Jr., A. A. F. Rivas, and D. MacKinlay (eds.). *Symposium Proceedings, Fish Communities and Fisheries. VI International Congress on the Biology of Fish, Manaus, Brazil*.
- Church, M. C., S. G. Baker, B. J. Clark, R. F. Carrillo, J. C. Horn, C. D. Spath, D. R. Guilfoyle, and E. S. Cassells. 2007. *Colorado History: A Context for Historical Archaeology*. Colorado Council of Professional Archaeologists, Denver.
- City of Evans. 2002. Comprehensive Plan. Available at: <http://www.cityofevans.org/department.cfm?depID=15#209>.
- City of Evans. 2006. Utility rates. Available at: <http://www.cityofevans.org/department.cfm?depID=13>.
- City of Fort Collins. 2000. Downtown River Corridor Implementation Program, Community Planning and Environmental Services Advance Planning Department. Adopted July 18.
- City of Fort Collins. 2002. Cache La Poudre Natural Areas Management Plan. Prepared by the Open Lands and Natural Areas Team.
- City of Fort Collins. 2004. Utilities' Water Supply and Demand Management Report. Table 6-2, page 6-5.
- Clark, B. J. 1999. The Protohistoric Period. In *Colorado Prehistory: A Context for the South Platte River Basin*, by K. P. Gilmore, M. Tate, M. L. Chenault, B. J. Clark, T. McBride, and M. Wood, pp. 309-336. *Colorado History: A Context for Historical Archaeology*. Colorado Council of Professional Archaeologists, Denver.
- CNHP (Colorado Natural Heritage Program). 2004. Colorado Natural Heritage Program environmental review, locations and status of rare and/or imperiled species and natural communities known from or likely to occur within the Laporte U.S. Geological Survey 7.5 Quadrangle in Larimer County, CO. Report generated 12 August 2004. Colorado State University.
- Coffman, M. 2006. Larimer County Parks. Personal communication with Karen Baud, Biologist, ERO Resources Corporation. June 16.
- Collins, J. A. and L. A. Sprague. 2005. The Cache la Poudre River, Colorado, as a Drinking-Water Source. U.S. Geological Survey Fact Sheet 2005-3037.
- Colorado Decision Support System (CDSS). 2005. HydroBase online database of historic diversion records. Available through the Colorado Division of Water Resources website: <http://water.state.co.us>. Accessed by HDR on November 4, 2005.
- Colorado Department of Agriculture, Colorado Agricultural Statistics Service and National Agricultural Statistics Service. 2003. "Colorado Agricultural Statistics: 2002 Preliminary – 2001 Revised." July.
- Colorado Department of Agriculture. 2004. Noxious Weed List. <http://www.colorado.gov/cs/Satellite?c=Page&cid>

- =1174084048733&pagename=Agriculture-Main%2FCDAGLayout. Accessed October 2007.
- Colorado Department of Public Health and Environment (CDPHE). 2006. Water Quality Control Commission Overview. Website: http://www.cdphe.state.co.us/op/wqcc/GeneralInfo/wqc_over.html. Accessed July 27, 2006.
- Colorado Department of Transportation. 2000. CDOT Standard Plans.
- Colorado Department of Transportation. 2003. Guidelines for Senate Bill 40 Wildlife Certification Developed and Agreed Upon by the Colorado Division of Wildlife and the Colorado Department of Transportation.
- Colorado Department of Transportation. 2005. CDOT Design Guide.
- Colorado Division of Wildlife. 1992. *Wildlife in danger: the status of Colorado's threatened or endangered fish, amphibians, birds, or mammals*. Available at: <<http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/WildlifeInDanger.htm?Print=true>>. Updated June 2006. Accessed July 17, 2006. 44 pgs.
- Colorado Division of Wildlife. 2005. *Colorado's comprehensive wildlife conservation strategy, including references to wildlife action plans*. Prepared for the citizens of Colorado and its visitors. Available at: <<http://wildlife.state.co.us/WildlifeSpecies/ComprehensiveWildlifeConservationStrategy>>. Accessed July 17, 2006.
- Colorado Division of Wildlife. 2006. Riparian and Wetland Mapping Page. Available at: <<http://ndis1.nrel.colostate.edu/riparian/riparian.htm>>. Downloaded May 2006.
- Colorado Natural Diversity Information System (CNDIS). 2005. GIS habitat coverage. Available at: <http://ndis.nrel.colostate.edu/ftp/ftp_response.asp>. Accessed January 2006. Last updated October 2005.
- Colorado Natural Diversity Information System (CNDIS). 2006. Available at: <<http://ndis.nrel.colostate.edu>>.
- Colorado Office of Economic Development. 2004. Colorado Data Book. Available at: http://www.state.co.us/oed/bus_fin/Databook2003/DB2004-Pop.pdf. Accessed December 2004.
- Colorado Water Conservation Board (CWCB). 2003. Tabulation of Instream Flow Water Rights – January 2003.
- Colorado Water Resources and Power Development Authority (CWRPDA). 1987. Cache la Poudre Basin Study. Final Report, v. I & II.
- Colton, R. B. 1978. Geologic map of the Boulder – Fort Collins – Greeley Area, Colorado. U.S. Geological Survey Map I-855-G (scale 1:100,000).
- Compass of Larimer County. 2005. Available at: <<http://www.larimer.org/compass/>>.
- Council on Environmental Quality. 1986. Forty Most Asked Questions Concerning CEQ's NEPA Regulations.
- Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deep water habitats of the United States. U.S. Fish and Wildlife Service, Office of Biological Services Program. FWS/OBS-79-31.
- Craig, G. R. and J. H. Enderson. 2004. Peregrine Falcon Biology and Management in Colorado. Colorado Division of Wildlife Technical Publication No. 43.
- Crowfoot, R. 2006. Peak discharge calculations completed using PeakFQ model for the Cache la Poudre and South Platte rivers at USGS gage locations. U.S. Geological Survey, Lakewood, CO. Personal communication with Seth Turner, HDR.
- Dennehy, K. F., D. W. Litke, C. M. Tate, S. L. Qi, P. B. McMahon, B. W. Bruce, R. A. Kimbrough, and J. S. Heiny. 1998. Water Quality in the South Platte River Basin, Colorado, Nebraska, and Wyoming, 1992-95. U.S. Geological Survey Circular 1167.
- Dennehy, K. F., D. W. Litke, P. B. McMahon, J. S. Heiny, and C. M. Tate. 1995. Water-Quality Assessment of the South Platte River Basin,

- Colorado, Nebraska, and Wyoming—Analysis of Available Nutrient, Suspended-Sediment, and Pesticide Data, Water Years 1980-92. U.S. Geological Survey Water-Resources Investigations Report 94-4095.
- Department of Local Affairs. 2006. "Population Totals; County Level Historical Census 1980 to 2000." Available at: <<http://www.dola.colorado.gov/demog/PopulationTotals.cfm>>. Accessed July 2006.
- DOE/Service (U.S. Department of Energy/U.S. Fish and Wildlife Service). 2001. Integrated Natural Resources Management Plan, Environmental Assessment, and Finding of No Significant Impacts for Rock Creek Reserve, 2001- Closure.
- DPNM (Dairy Producers of New Mexico). 2006. Frequently Asked Questions About New Mexico Dairies. <http://www.nmdairy.org/faq1.htm> Downloaded on April 14, 2006.
- Dunne, T. and L.B. Leopold. 1978. Water in Environmental Planning. W.H. Freeman and Co., NY.
- Earthinfo, Inc. 2006. U.S. Geological Survey Quality of Water, Surface West 1 2005. Boulder, CO.
- Environment Colorado Research and Policy Center. 2006. "Losing Ground: Colorado's Vanishing Agricultural Land." March.
- Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station. Vicksburg, MS.
- EPA (Environmental Protection Agency). 1998a. Available at: <http://www.epa.gov/WaterSense/>. Last accessed: October 2007.
- EPA (Environmental Protection Agency). 1998b. Available at: EPA.gov/watrhme/use/cap1.html.
- ERO (ERO Resources Corporation). 2004. Preble's Meadow Jumping Mouse Survey Report for Glade Reservoir site. January 19, 2005.
- ERO (ERO Resources Corporation). 2005a. Northern Integrated Supply Project Environmental Impact Statement Scoping Report. Prepared for the U.S. Army Corps of Engineers Omaha District.
- ERO (ERO Resources Corporation). 2005b. Windy Gap Firing Project Purpose and Need Report. Prepared for the Bureau of Reclamation.
- ERO (ERO Resources Corporation). 2005c. Black-footed Ferret Survey for Galetton Reservoir Site Report. September 21.
- ERO (ERO Resources Corporation). 2005d. Northern Integrated Supply Project Environmental Impact Statement U.S. 287 Realignment Public Open House. Prepared for the U.S. Army Corps of Engineers Omaha District.
- ERO (ERO Resources Corporation). 2006a. Preliminary Draft Windy Gap Firing Project DEIS Chapter 1—Purpose and Need. Prepared for the Bureau of Reclamation.
- ERO (ERO Resources Corporation). 2006b. Northern Integrated Supply Project Endangered Species Habitat Assessment Report. Submitted to the U.S. Fish and Wildlife Service. October 4.
- ERO (ERO Resources Corporation). 2006c. Northern Integrated Supply Project Environmental Impact Statement Hazardous Sites Technical Report. Prepared for the U.S. Army Corps of Engineers.
- ERO (ERO Resources Corporation). 2007. Cache la Poudre and South Platte Rivers Ground Water Technical Memoranda. Prepared for the U.S. Army Corps of Engineers and Northern Colorado Water Conservancy District. January 2.
- ERO (ERO Resources Corporation). 2008a. Northern Integrated Supply Project Environmental Impact Statement Vegetation Technical Report. Prepared for the U.S. Army Corps of Engineers.
- ERO (ERO Resources Corporation). 2008b. Northern Integrated Supply Project Environmental Impact Statement Wetlands and Other Waters Technical Report. Prepared for the U.S. Army Corps of Engineers.
- ERO (ERO Resources Corporation). 2008c. Northern Integrated Supply Project

- Environmental Impact Statement Wildlife Resources Technical Report. Prepared for the U.S. Army Corps of Engineers.
- ERO (ERO Resources Corporation). 2008d. Northern Integrated Supply Project Environmental Impact Statement Species of Concern Technical Report. Prepared for the U.S. Army Corps of Engineers.
- ERO (ERO Resources Corporation). 2008e. Northern Integrated Supply Project Environmental Impact Statement Recreation Resources Technical Report. Prepared for the U.S. Army Corps of Engineers.
- ERO (ERO Resources Corporation). 2008f. Northern Integrated Supply Project Environmental Impact Statement Cumulative Effects Technical Report. Prepared for the U.S. Army Corps of Engineers.
- ERO (ERO Resources Corporation). 2008g. Northern Integrated Supply Project Environmental Impact Statement Land Use Technical Report. Prepared for the U.S. Army Corps of Engineers.
- ERO (ERO Resources Corporation). 2008h. South Platte River near Kersey Stream Morphology Technical Report. Prepared for the U.S. Army Corps of Engineers, Omaha District. March 2008.
- ERO (ERO Resources Corporation). 2008i. Northern Integrated Supply Project Environmental Impact Statement Visual Resources Comprehensive Technical Report. Prepared for the U.S. Army Corps of Engineers.
- ERO (ERO Resources Corporation). 2008j. Cactus Hill Reservoir Salinity Model Technical Report. Prepared for the U.S. Army Corps of Engineers and Northern Colorado Water Conservancy District.
- ERO (ERO Resources Corporation) and HDR (HDR Engineering, Inc.). 2008. Northern Integrated Supply Project Water Quality Technical Report. Prepared for the Army Corps of Engineers. January 2007.
- ERO (ERO Resources Corporation) and Holdeman Landscape Architects (HLA). 2008. Northern Integrated Supply Project Environmental Impact Statement Visual Resources Technical Report. Prepared for the U.S. Army Corps of Engineers.
- Fardal, L. 2003. NISP Technical Memorandum No. 5F: Big Thompson Yield Analysis.
- Fardal, L. 2004. NISP Technical Memorandum No. 5E: Upper St. Vrain Yield Analysis.
- Ficke, J. F. and T. W. Danielson. 1973. Lakes in the Boulder-Fort Collins-Greeley Area, Front Range Urban Corridor, Colorado. USGS Miscellaneous Investigations Series, Boulder-Fort Collins-Greeley Area, Colorado, Map I-855-A.
- Fitzgerald, J. P., C. A. Meaney, and D. M. Armstrong. 1994. Mammals of Colorado. University Press of Colorado and Denver Museum of Natural History.
- Fleming, C. 2003. Larimer County, Carter Lake Senior Ranger. Personal communication with Aleta Powers, ERO Resources Corporation. January 29.
- Fort Collins. 2000. Downtown River Corridor Implementation Program, Community Planning and Environmental Services Advance Planning Department. Adopted July 18.
- Frick, D. M., D. Bode, and J. D. Salas. 1990. Effect of Drought on Urban Water Supplies. I: Drought Analysis. *Journal of Hydraulic Engineering*, v. 116 (6): 733-753.
- Friends of the Poudre. 2006. Description of proposed water park. Available at: <http://www.themountainshop.com/projects/cope0406.shtml>. Accessed June 1, 2006.
- GEI Consultants, Inc. (GEI). 2006a. Technical Memorandum No. 1: Northern Integrated Supply Project Preliminary Assessment of Glade Dam and Reservoir and Associated Facilities. Prepared for the Northern Colorado Water Conservancy District. May 10.
- GEI Consultants, Inc. (GEI). 2006b. Technical Memorandum No. 2: Northern Integrated Supply Project (NISP) Preliminary Assessment of Galeton Dam and Reservoir and Associated Facilities. Prepared for the NCWCD.

- GEI Consultants, Inc. (GEI). 2006c. Technical Memorandum No. 3: Northern Integrated Supply Project Preliminary Assessment of Cactus Hill Dam and Reservoir and Associated Facilities. Prepared for the Northern Colorado Water Conservancy District.
- GEI Consultants, Inc. (GEI). 2006d. Northern Integrated Supply Project Aquatic Biological Resources Technical Report. Prepared for the U.S. Army Corps of Engineers.
- GEI Consultants, Inc. (GEI). 2008. Aquatic Biological Resources Technical Report. NISP Environmental Impact Statement. Prepared for the U.S. Army Corps of Engineers.
- Gibbens, J. 2006 (Revised). NISP Technical Memorandum No. 6C: South Platte River Hydrology.
- Gilliam, C. S. 2006. Channel Planform Alteration and Cottonwood Stem Growth Along the Cache la Poudre River, Southeast of Fort Collins, Colorado (1991-1999). M.S. Thesis, Colorado State University. Fort Collins, CO.
- Gilmore, K. P., M. Tate, M. Chenault, B. Clark, T. McBride, and M. Wood. 1999. Colorado Prehistory: A Context for the Platte River Basin. Colorado Council of Professional Archaeologists, Denver, CO.
- Hall, J. D. and N. J. Knight. 1981. Natural Variation in Abundance of Salmonid Populations in Streams and Its Implications for Design of Impact Studies, A Review. EPA-Hilsenhoff 600/3-81-021. Oregon State University, Department of Fisheries and Wildlife.
- Hammerson, G. A. 1999. Amphibians and reptiles in Colorado, Second edition. University Press of Colorado/Colorado Division of Wildlife.
- HDR (HDR Engineering, Inc.). 2005a. NISP Hydrologic Model Review Report. Final. Prepared for the U.S. Army Corps of Engineers.
- HDR (HDR Engineering, Inc.). 2005b. NISP Hydrologic Model Revision Report. Final. Prepared for the U.S. Army Corps of Engineers.
- HDR (HDR Engineering, Inc.). 2006. Summary Memorandum, Participant Existing Supplies. Prepared for the U.S. Army Corps of Engineers, Omaha District.
- HDR (HDR Engineering, Inc.). 2007a. Alternatives Evaluation Report, Volumes I and II. Prepared for the U.S. Army Corps of Engineers Omaha District.
- HDR (HDR Engineering, Inc.). 2007b. Northern Integrated Supply Project Environmental Impact Statement Water Resources Technical Report. Prepared for the U.S. Army Corps of Engineers.
- HDR (HDR Engineering, Inc.) and BBC. 2007. Northern Integrated Supply Project, Socioeconomic Resources Technical Report. Prepared for the U.S. Army Corps of Engineers, Wyoming Regulatory Office, Cheyenne. [March].
- Harvey Economics (HE). 2006. Water Supply and Demands for Participants in the Northern Integrated Supply Project.
- Hoffman, G. J. 2004. Impact of utilizing Water Supplies from the South Platte Water Conservation Project on Crop Production. Report made to the Northern Colorado Water Conservancy District.
- Hoover, S. 2005. Northeast Regional Manager for the Colorado Division of Wildlife. Letter to Mr. Chandler Peter. April 19.
- Hurd, E. Shaw, N., Mastrogiuseppe, J., Smithman, L., and Goodrich, S. 1998. Field Guide to Intermountain Sedges. Uda – Forest Service. Rocky Mountain Research Station.
- IASCD (Idaho Association of Soil Conservation Districts). 2004. Fresh Water for Dairy Farms. <http://www.oneplan.org/Stock/DairyWater.shtml>. Downloaded on April 14, 2006.
- IMPLAN. 2006. Minnesota IMPLAN Group, 2003 County data files and economic impact model. 2006. <http://www.implan.com/>.
- Integra Engineering. 2005a. South Platte Water Conservation Project Alternatives Analysis. Northern Colorado Water Conservancy District

- Technical Memorandum No. 1. May 2005.
Prepared for the Northern Colorado Water Conservancy District.
- Integra Engineering. 2005b. Glade to Horsetooth Reservoir Pipeline Route Analysis. Northern Colorado Water Conservancy District Technical Memorandum No. 2. May 2005. Prepared for the Northern Colorado Water Conservancy District.
- Integra Engineering. 2005c. Munroe Canal By-Pass Alternatives Analysis. Northern Colorado Water Conservancy District Technical Memorandum No. 3. April 2005. Prepared for the Northern Colorado Water Conservancy District.
- Intergovernmental Panel on Climate Change (IPCC). 2001. Climate change 2001: The scientific basis. In: Houghton, J.T. and Ding, Y. (eds). Cambridge, Cambridge, UK.
- Kehmeier, K. 2005. Colorado Division of Wildlife Aquatic Biologist. Personal communication with Karen Baud, Biologist, ERO Resources Corporation. June 2.
- Kehmeier, K. 2006. Colorado Division of Wildlife Aquatic Biologist. Personal communication with Stacey Antilla, Natural Resource Planner, ERO Resources Corporation. December 4.
- Kingery, H. E. (ed.). 1998. Colorado Breeding Bird Atlas. Colorado Bird Atlas Partnership and Colorado Division of Wildlife, Denver.
- Knopf, F. L. 1996. Mountain Plover (*Charadrius montanus*). In *The Birds of North America*, no. 211 (A. Poole and F. Gill, eds.) The Academy of Natural Sciences, Philadelphia, P.A. and The American Ornithologists' Union, Washington, DC.
- Kramer, M. 2001. Smart Growth Hall of Fame 2001, Ten Examples of Good Planning Decisions in Colorado. A Report of the Colorado Sprawl Action Center. December.
- Larimer County Parks and Open Lands. 2006. Available at: <http://www.co.larimer.co.us/parks/>. Last update June 6, 2006. Accessed June 6, 2006.
- Larimer County Planning and Building Services Division. 2002. Larimer County Land Use Code. Website available at: <http://www.co.larimer.co.us/planning/>. March 18.
- Larimer County Planning and Building Services Division. 2004.
- Larimer County Planning and Building Services Division. 2005 Annual Report. Website available at: <http://www.co.larimer.co.us/planning/>.
- Larimer County Planning Department. 1996.
- Larimer County. 1997. Larimer County Comprehensive Plan. Available at: http://www.co.larimer.co.us/planning/planning/master_plan/toc.htm.
- Larimer County. 2001. Larimer County Open Lands Master Plan. Available at: http://www.co.larimer.co.us/parks/openlands/master_plan.pdf.
- Larimer County. 2005. Larimer County Annual Report. Available at: http://www.co.larimer.co.us/planning/annual_report/2005_annual_report.pdf.
- Larimer County. 2006a. Horsetooth District Visitation Study.
- Larimer County. 2006b. Available at: <http://www.co.larimer.co.us/parks/>. Last updated June 6, 2006. Accessed June 6, 2006.
- Leland, H. V., S. V. Fend, J. L. Carter, and A. D. Mahood. 1986. Composition and abundance of periphyton and aquatic insects in a Sierra Nevada, California, stream. *Great Basin Naturalist* 46:595-611.
- Lewis, W. M., Jr. 2003. Water Quality Considerations for the Proposed Glade Reservoir. November 18.
- Litke, D. W. 1995. Nutrients in the South Platte River, 193-1995. U.S. Geological Survey NAWQA Fact Sheet. FS-105-95.
- MacDonnell, L. J. 1989. Water Quality and Water Rights in Colorado. Colorado Water Resources Research Institute. Completion Report No. 151.
- Martell, M. 1992. Bald Eagle Winter Management Guidelines. USFWS, Reg. 3, Minneapolis, MN.

- Mayo, E. 2007. Personal conversation with Ellen Mayo, USFWS, and Denise Larson, ERO Resources Corporation. May 2.
- McKissick, J. 2006. Colorado Division of Wildlife. Personal communication with J. Lynch, Aquatic Biologist, Chadwick Ecological Consultants, Inc. May 25.
- Meaney, C. A., A. Deans, N. W. Clippenger, M. Rider, N. Daly, and M. O'Shea-Stone. 1997. Third year survey for Preble's meadow jumping mouse (*Zapus hudsonius preblei*) in Colorado. Under contract to Colorado Division of Wildlife. Boulder, CO.
- MERCO. 2006a. Noise Assessment Report. Northern Colorado Water Conservancy District Northern Integrated Supply Project Preliminary Engineering for Alternatives Development Highway U.S. 287 Relocation Study. Prepared for Muller Engineering.
- MERCO. 2006b. Air Quality Report. Northern Colorado Water Conservancy District Northern Integrated Supply Project Preliminary Engineering for Alternatives Development Highway U.S. 287 Relocation Study. Prepared for Muller Engineering.
- Montana Department of Transportation. 1996. Montana Wetland Field Evaluation Form and Instructions.
- Montano, P. 2006. Letter to Mr. Chandler J. Peter regarding NISP Project, West Slope Alternative. March 28.
- Morgan County. 2004. Land Use Information. Morgan County Comprehensive Plan.
- Morgan, M. L. 2007. Colorado's Earthquake and Fault Map. Colorado Geological Survey (scale 1:1,150,000).
- Moulton II, S. R., J. G. Kennen, R. M. Goldstein, and J. A. Hambrook. 2002. Revised Protocols for Sampling Algal, Invertebrate, and Fish Communities as Part of the National Water Quality Assessment Program. U.S. Geological Survey Open-File Report 02-150. Reston, VA.
- Muller Engineering. 2006a. Draft Report. U.S. 287 Realignment. Design Memorandum. Prepared for the Northern Colorado Water Conservancy District.
- Muller Engineering. 2006b. Alignment Alternative J. Engineers Opinion of Probable Construction Costs – Conceptual Level. May 4.
- Muller Engineering. 2006c. Alignment Alternative F. Engineers Opinion of Probable Construction Costs – Conceptual Level. May 4.
- Muller. 2007. U.S. 287 Relocation Study.
- MWH. 2004. NISP Phase II Alternative Evaluation. Final Report. Prepared for the Northern Colorado Water Conservancy District.
- NASS (National Agricultural Statistics Service). 1987. Data for Morgan County. Available at: <http://www.nass.usda.gov/index.asp>.
- NASS (National Agricultural Statistics Service). 2002. Data for Morgan County. Available at: <http://www.nass.usda.gov/index.asp>.
- NASS (National Agricultural Statistics Service). 2005. Data for Weld County. <http://www.nass.usda.gov/index.asp>. Downloaded on April 14, 2006.
- National Register of Historic Places. 1998. National Register Bulletin.
- National Research Council. 2007. Colorado River Basin Water Management: Evaluating and Adjusting to Hydroclimatic Variability. The National Academies Press. Washington DC. Available at: <http://www.nap.edu/catalog/11857.html>.
- NatureServe. 2006. Available at: <http://www.natureserve.org/explorer/servlet>.
- NCWCD (Northern Colorado Water Conservancy District). 1981. Windy Gap Project.
- NCWCD (Northern Colorado Water Conservancy District). 2002. South Platte Water Conservation Project: Project Completion Study Report.
- NCWCD (Northern Colorado Water Conservancy District). 2005. Memorandum on U.S. 287 Relocation–Level 1 and 2a Analysis. From Jerry

- Kenny, Karen Creamer, and Doug Emmons. November.
- NCWCD (Northern Colorado Water Conservancy District). 2006. Draft memorandum regarding NISP Alternatives Costs. From Mr. Carl Brouwer to Mr. Jerry Kenny. March 21.
- NCWCD (Northern Colorado Water Conservancy District). 2007. Memorandum on Additional Waters Contemplated to be Diverted by Glade Reservoir. From Mr. Carl Brouwer to Steve Dougherty. January 16.
- Nelson, D. Long-Billed Curlew. In Kingery, H. E. (ed.) 1998. Colorado Breeding Bird Atlas. Colorado Bird Atlas Partnership and Colorado Division of Wildlife, Denver. Pp. 182 and 183.
- Nesler, T. P. 1997. *Native and Introduced Fish Species by Major River Basins in Colorado*. Nongame & Endangered Aquatic Wildlife Program.
- Nesler, T. P., R. VanBuren, J. A. Stafford, and M. Jones. 1997. Inventory and status of South Platte River native fishes in Colorado. Final Report. Colorado Division of Wildlife, Fort Collins, CO.
- NRCS. 1980. Soil Survey of Larimer County Area, Colorado.
- NRCS. 1982a. Soil Survey of Weld County, Northern Part, Colorado.
- NRCS. 1982b. Important Farmland Inventory, Colorado. U.S. Department of Agriculture.
- NRCS. 2007. Website accessed January 11, 2007. Available at:
<http://soildatamart.nrcs.usda.gov/Report.aspx?Survey=CO618&UseState=CO>.
- Parker, Colorado Economic Development Council. 2003. The Colorado Economy. Available at:
<www.parkercolorado.org/coloradoeconomy>
Accessed January 2005.
- Paulson, C. 2003. NISP Technical Memorandum No. 7: No-Action Alternative.
- Pearsons, T. N., H. W. Li, and G. A. Lamberti. 1992. Influence of habitat complexity on resistance to flooding and resilience of stream fish assemblages. *Transactions of the American Fisheries Society* 121:427-436.
- Peterson, J. A. 1972. Jurassic System: In: *Geologic Atlas of the Rocky Mountain Region* (W. W. Mallory, Ed.): Rocky Mountain Association of Geologists, Denver, Colorado, p. 177-189.
- Platts, W. S. and R. L. Nelson. 1988. Fluctuations in trout populations and their implications for land-use evaluation. *North American Journal of Fisheries Management* 8:333-345.
- Power, M. E., D. Tilman, J. A. Estes, B. A. Menge, W. T. Bond, L. S. Mills, G. Daily, J. C. Castilla, J. Lutchonco, and R. T. Paine. 1996. Challenges in the Quest for Keystone Species. *BioScience* 46:609-620.
- Propst, D. L. 1982. Warmwater fishes of the Platte River Basin, Colorado; distribution, ecology, and community dynamics. Dissertation. Department of Fishery and Wildlife Biology. Colorado State University, Fort Collins, CO.
- Red Oak Consulting, 2006. NISP Master Financing Plan. November.
- Resource Consultants, Inc. 1985. Droughts and Their Effect on the Water Supplies for the City of Fort Collins, CO.
- RMBO (Rocky Mountain Bird Observatory). 2004. Final Report on Habitat Use and Breeding Activities of Bald Eagles Nesting at Standley Lake, 2002-2004.
- RMBO (Rocky Mountain Bird Observatory). 2005. Bald Eagle Watch 2005 Report. Unpublished data provided to ERO on September 7, 2005.
- RMP (Rocky Mountain Paleontology). 2006. Paleontological Technical Report: Northern Integrated Supply Project, Proposed U.S. 287 Realignment, Larimer County, CO. Prepared for ERO Resources Corporation.
- Rogstad, L. 2007. District Wildlife Manager, CDOW. Personal communication with Stacey Antilla, Natural Resource Planner, ERO Resources Corporation. May 21.
- Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

- RTi. 2005. NISP Technical Memorandum No. 3: Network Exchanges.
- Ryan, S. 1999. Property Values and Transportation Facilities: Finding the Transportation-Land Use Connection. *Journal of Planning Literature*, Vol. 13, No. 4. May.
- Sawyer, H. and F. Lindzey. 2000. Jackson Hole Pronghorn Study. Wyoming Cooperative Fish and Wildlife Research Unit, Laramie, WY.
- Schmidt, L. J. and J. P. Potyondy. 2004. Quantifying Channel Maintenance In streamflows: An Approach for Gravel-Bed Streams in the Western United States. USDA, Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-128. May.
- Scott, J. and C. Paulson. 2003. NISP Technical Memorandum No. 3: Review of Water Resources Information.
- Shieh, S. H., B. C. Kondratieff, J. V. Ward, and D. A. Rice. 1999. The relationship of macroinvertebrate assemblages to water chemistry in a polluted Colorado plains stream. *Arch. Hydrobiol.* 145(4):405-432.
- Society of Vertebrate Paleontology. 1995. Assessment and mitigation of adverse impacts to nonrenewable paleontologic resources – standard guidelines: *Society of Vertebrate Paleontology News Bulletin*, vol. 163, p. 22-27.
- South Platte Decision Support System (SPDSS). 2004. SPDSS Memorandum. Task 3 – Identify Key Diversion Structures, Notes from Water District 3 Meeting.
- South Platte Decision Support System (SPDSS). 2005. SPDSS Memorandum. Task 5 – Key Municipal User, City of Fort Collins.
- Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, the U.S. Forest Service, and the U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program.
- Sprague, L. A. and A. I. Greve. 2003. Changes in Nutrient and Pesticide Concentrations in Urban and Agricultural Area of the South Platte River Basin, Colorado, Wyoming, and Nebraska, 1994-2000. U.S. Geological Survey Water- Resources Investigations Report 02-4270.
- State of Colorado. 2002. State Highway Access Code.
- Town of Timnath. 2005. Timnath Master Trail Plan. Available at: <http://timnathcolorado.org/page_cityplanning.htm>. Accessed December 18, 2006.
- U.S. Army Corps of Engineers (Corps), Omaha District. 2004. Draft Report. Remedial Investigation Site Characterization Summary, F.E. Warren Air Force Base Former Atlas “E” Missile Site 13, Laporte, CO. September.
- U.S. Army Corps of Engineers (Corps). 2006. Cache la Poudre at Greeley, Colorado G.I. Study. Executive Summary.
- U.S. Census Bureau. 2000. Available at: <<http://www.co.boulder.co.us/lu/demographics/census2000.htm>>.
- U.S. Fish and Wildlife Service (Service). 1981. The Platte River Ecology Study Special Research Report. U.S. Fish and Wildlife Service, Jamestown, ND; Northern Prairie Wildlife Research Center Online. Available at: <<http://www.npwrc.usgs.gov/resource/habitat/plrivedeco/plriveco.htm>>.
- U.S. Fish and Wildlife Service (Service). 1984. American peregrine falcon recovery plan (Rocky Mountain/Southwest population). Prepared in cooperation with the American Peregrine Falcon Recovery Team, U.S. Fish and Wildlife Service, Denver, CO.
- U.S. Fish and Wildlife Service (Service). 1989. Black-footed Ferret Survey Guidelines for Compliance with Endangered Species Act. Denver, CO and Albuquerque, NM.
- U.S. Fish and Wildlife Service (Service). 1992a. Endangered and Threatened Wildlife and Plants: Listing of *Spiranthes diluvialis* as threatened, Final Rule. *Federal Register*, Volume 57, No. 12, January 17.

- U.S. Fish and Wildlife Service (Service). 1992b. Interim Survey Guidelines for *Spiranthes diluvialis* (Ute ladies'-tresses orchid). November 23.
- U.S. Fish and Wildlife Service (Service). 1993. Management of Prairie Dog Complexes for the reintroduction of the Black-footed Ferret. Fort Collins, CO; Arlington, VA; and Washington, DC.
- U.S. Fish and Wildlife Service (Service). 1998. Consultation Handbook.
- U.S. Fish and Wildlife Service (Service). 2004. Endangered and Threatened Wildlife and Plants: Designated Critical Habitat for Colorado butterfly plant, Proposed Rule. Federal Register, Volume 79, No. 151. August 6.
- U.S. Fish and Wildlife Service (Service). 2005a. Federally Listed and Proposed, Endangered, Threatened, Experimental and Candidate Species and Habitat in Colorado by County. March 2005. Available at: <www.r6.fws.gov/endspp/countylists/COLORADO.htm>.
- U.S. Fish and Wildlife Service (Service). 2005b. Unpublished trapping database for Preble's meadow jumping mouse. Last updated September 2005.
- U.S. Fish and Wildlife Service (Service). 2006a. National Wetland Inventory.
- U.S. Fish and Wildlife Service (Service). 2006b. Federally Listed and Proposed, Endangered, Threatened, Experimental, and Candidate Species and Habitat in Colorado by County. Available at: <<http://www.r6.fws.gov/endspp/CountyLists/COLORADO.htm>>.
- U.S. Fish and Wildlife Service (Service). 2007. ULTO and CBP letter from Allan Pfister. January 9.
- U.S. Fish and Wildlife Service (Service). 2008. Personal communication from Adam Misztal, Colorado Field Office Fish and Wildlife Biologist, to Chandler Peter, Corps of Engineers Omaha District, regarding review of habitat assessments for *Zapus hudsonius preblei*. January 25.
- U.S. Forest Service. 1996. Probable fossil yield classification (PFYC): Developed by the Paleontology Center of Excellence and the Region 2 (USFS) Paleo Initiative.
- USDA-NASS. 2007. Agricultural census data. Website accessed June 20. Available at: <http://www.nass.usda.gov/index.asp>.
- USGS (U.S. Geological Survey). 1996. Estimated Water Use at Dairy Farms in Gooding, Jerome, and Twin Falls Counties, Idaho, 1990-93. USGS, National Water-Quality Assessment Program. Fact Sheet FS-111-96. M.A. Maupin, 1996. <http://water.usgs.gov/nawqa/> Downloaded on April 14, 2006.
- USGS (U.S. Geological Survey). 2000. Water Supply and Use. <http://water.usgs.gov/watuse/> Last accessed: October 2007.
- USGS (U.S. Geological Survey). 2003. USGS NAWQA Data Retrieval- South Platte River Basin. Website: <http://www.water.gov/nawqa>. Accessed May 19, 2006.
- USGS (U.S. Geological Survey). 2005a. Colorado Water Resources Data. Earthinfo, Inc. Daily Values CD, West 1. Boulder, CO.
- USGS (U.S. Geological Survey). 2005b. Quaternary Fold and Fault Database for the United States. Greeley 1°x2° Sheet. URL: <http://earthquake.usgs.gov/regional/qfaults/co/gre.html>.
- U.S. Geological Survey – Northern Prairie Wildlife Research Center. 2006. Butterflies of Colorado – *Atrytone arogos*. Available at: <www.npwrc.usgs.gov/resoure/distr/lepid/bflyusa/co/450.htm>.
- Utah Economic and Business Review. 2005. Water Use and Residential Rate Structures in the Intermountain West. Volume 65, March/April.
- Vieira, M., M. Sherman, and S. Craig. 2008. Colorado Division of Wildlife biologists. Personal communication with K. Baud, ERO Resources Corporation. February 18.

- Waage, K. M. 1955. Dakota Group in Northern Front Range Foothills, Colorado: U. S. Geological Survey Professional Paper 274-B.
- WCRM (Western Cultural Resource Management, Inc.). 2007. Northern Integrated Supply Project, Cultural Resources Technical Report. Prepared for the U.S. Army Corps of Engineers, Wyoming Regulatory Office, Cheyenne. March.
- Weber, W. and Wittman, R. 2001. Colorado Flora – Eastern Slope. University Press of Colorado. Boulder, CO.
- Western Resource Advocate. 2003. Smart Water, Page 66.
- Winternitz, B. Bald Eagle. In Kingery, H. E. (ed.). 1998. Colorado Breeding Bird Atlas. Colorado Bird Atlas Partnership and Colorado Division of Wildlife, Denver.
- Wohl, E. 1998. Inheriting Our Past: River Sediment Sources and Sediment Hazards in Colorado. Colorado Water Resources Research Institute, No. 7, June 1998.
- Wohl, E. 2001. Virtual Rivers: Lessons from the Mountain Rivers of the Colorado Front Range. Yale University Press, New Haven, CT.
- Woodling, J. 1985. *Colorado's little fish: a guide to the minnows and other lesser known fishes in the State of Colorado*. Colorado Division of Wildlife, Denver, CO.

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GLOSSARY

Acre-Foot (AF). The amount of water that would cover 1 acre with 1 foot of water. One AF is equal to 0.326 million gallons (mg).

Active demand management strategy. Reduced water use, accomplished either through temporary measures such as restrictions during a drought, or through long-term conservation programs. These programs include replacement of inefficient fixtures with more efficient fixtures such as 1.6 gallon toilets, installation and maintenance of landscapes that have low water requirements, or changes in customer attitudes that lead to reduction in water use.

Adjudicated water rights. Water rights that are either an absolute water right, a conditional water right, a finding of reasonable diligence, an exchange, an augmentation plan, a change of water right, or a right to withdraw tributary water or ground water that is outside of a designated ground water basin.

Adjudication date. The date when the Court enters a decree confirming a water right.

Allottees. Allottees are shareholders in a ditch company, the C-BT system, special water district or other mutual water supply entity.

Alluvial aquifer. A permeable formation which forms naturally underground by deposition of weathered material such as sand and silt particles and stores or conducts groundwater to wells and springs. Water flow in these types of aquifers is very slow.

Annual firm yield. Also firm yield or dry-year firm yield. The annual yield that is available during a defined drought period. The defined drought period is the drought period in the hydrologic record

developed for hydrologic modeling, for NISP the defined drought period is 1954, 1955, and 1956.

Annual yield. The amount of water that is available during a given year. The annual yield may vary from year to year.

Appropriation date. The date when the placement of a specified portion of the previously unappropriated waters of the state can be put to beneficial use pursuant to the procedures prescribed by law.

Average yield. The yield that is available during an average water year.

Bald eagle active nest. A specific location in which a pair of bald eagles have at least attempted to nest within the last 5 years. Any nest location that can be directly tied to courtship, breeding, or brooding behavior is considered active. A buffer zone extends .5 mile around a known active nest.

Bald eagle communal roost. Groups of or individual trees used by more than 15 eagles for diurnal and/or nocturnal perches.

Bald eagle roost site. Groups of trees or individual trees that provide diurnal and/or nocturnal perches for less than 15 wintering bald eagles; includes a buffer zone extending 1/4 mile around these sites. These trees are usually the tallest available trees in the wintering area and are primarily located in riparian habitats.

Bald eagle winter concentration areas. Areas (tree, islands, etc.) within an existing winter range where eagles concentrate between November 15 and April 1. These areas may be associated with roost sites.

Bald eagle winter range. Areas where bald eagles have been observed between November 15 and April 1.

Bedrock aquifer. A geologic bedrock unit that has the porosity and permeability to release water in quantities sufficient to supply reasonable amounts of water to wells.

Bighorn sheep winter concentration area. That part of the winter range where densities are at least 200 percent greater than the surrounding winter range density during the same period used to define winter range in the average five winters out of 10.

Biodiversity. The range of organisms present in a given ecological community or system. It can be measured by the numbers and types of different species, or the genetic variations within and between species.

Buildout. The area of land projected to be developed as part of a municipality or district in the future. Generally, the prediction is for maximum capacity for the residential, commercial, industrial, and municipal development of that community.

Carrying right (also called a right of carriage). A legal provision granting access to and use of a conduit such as an irrigation canal for the transport of water owned by an entity that does not otherwise own shares of stock in the mutual irrigation company which owns the conduit.

Cash-in-lieu. Municipalities that require new developments to provide water rights may also choose to accept cash to fund the purchase of new water rights. In this way, the municipality is provided with funds to purchase the water rights necessary to supply the development.

C-BT quota. The AF per C-BT unit or share.

C-BT share, or C-BT unit. A share in, or unit of the Colorado-Big Thompson project. A C-BT share

or unit ranges from 0.5 AF to 1.0 AF depending on the year. The District estimates that the firm yield of a C-BT unit is 0.6 AF, and the average yield of a unit is 0.7 AF.

C-BT. Colorado Big-Thompson project.

Combined firm yield. The firm yield for more than one entity (in this case, the NISP Participants).

Comprehensive plan. A plan developed by a municipality to dictate goals, objectives, and priorities for the future management of that municipality.

Conditional storage right. See conditional water right. A right to perfect a water right with a certain priority upon completion of a storage vessel such as a reservoir.

Conditional water right. A right to perfect a water right with a certain priority upon the completion, with reasonable diligence, of the appropriation upon which such water right is to be based.

Conjunctive use. Coordinated use of surface and ground water supplies to meet demand so that both sources are used more efficiently.

Consumptive use. The amount of water used up by application of that water to beneficial use. Examples include: water for drinking and water taken up by growing crops.

Cooperating agency. A federal, state, tribal or local agency having special expertise with respect to an environmental issue or jurisdiction by law may be a cooperating agency in the NEPA process. A cooperating agency has the responsibility to assist the lead agency by participating in the NEPA process at the earliest possible time; by participating in the scoping process; in developing information and preparing environmental analyses including portions of the environmental impact statement concerning which the cooperating agency has special

expertise; and in making available staff support at the lead agency's request to enhance the lead agency's interdisciplinary capabilities.

CRRP (Colorado River Return Project). The CRRP, also known as the Big Straw, would likely consist of a diversion on the Colorado River near the Utah border, a pipeline to a West Slope storage reservoir (such as Dillon Reservoir), and additional infrastructure to deliver water to various water providers on the Eastern Slope. The CRRP likely would be state funded. It is estimated that the CRRP could pump from 280,000 to 400,000 AF annually from the Utah border.

Cut slope. The excavated portion of a roadway located upslope from the road surface.

CWCWD. Central Weld County Water District.

Dead pool. The lowest portion of the reservoir, which is below the elevation of the outlet and, therefore, cannot be drained by the outlet works.

District. Northern Colorado Water Conservancy District.

Drought protection. The steps that water providers take to buffer their water supply systems and portfolios against a drought. Drought protection measures may include planning water supplies based on firm yield, implementing drought restrictions, storing adequate amounts of water to save water for droughts.

Dry year firm yield. Firm yield.

Dry year lease. A water right owner leases water to another user during a dry year.

Dry year transfer. A temporary transfer of water for dry year water supply. Also known as temporary transfers, dry year transfers are implemented as part of a water rights option agreement between a lessor and a lessee.

Eaton. Town of Eaton.

EIS team. A team composed of representatives from the U.S. Army Corps of Engineers and its third-party consultants (ERO Resources Corporation, BBC, HDR Engineering, and other subconsultants) that have worked together to prepare this EIS.

Ephemeral. A drainage basin or stream that flows during storm events or other wet events. Typically not supplied by ground water.

EPT taxa. Ephemeroptera, Plecoptera, Trichoptera (EPT) taxa that are aquatic invertebrates include mayflies, stoneflies, and caddis flies.

Erie. Town of Erie.

Evans. City of Evans.

Exchange. A process by which water, under certain conditions, may be diverted out of priority at one point by replacing a like amount of water at a downstream location.

Existing conditional water right. A right to perfect a water right with a certain priority upon completion, with reasonable diligence, of the appropriation upon which water right is to be based.

Exotic vegetation or wildlife. Plant or animal species not native to a particular location.

FCLWD. Fort Collins-Loveland Water District.

Federal action. An action by a federal agency. Federal actions may include supplying funding for a project, authorizing or permitting a project, undertaking or sponsoring a project.

Federal project. A project conducted by or funded by the federal government.

Field eligible (for listing in the National Register of Historic Places). Historical or archaeological resources that are recommended by a cultural resource specialist as potentially eligible for listing

in the National Register of Historic Places. The recommendation is considered preliminary until review and consultation by the State Historic Preservation Office at which time a determination of eligibility is provided.

Fill slope. The fill portion of the roadbed located down slope from the road surface.

Firm supply. Firm yield.

Firm yield. Also firm annual yield or dry-year firm yields. The annual yield that is available during a defined drought period. The defined drought period is the drought period in the hydrologic record developed for hydrologic modeling, for NISP the defined drought period is 1954, 1955, and 1956.

Firming storage. Storage necessary to firm, or make available, a water right.

Firming. Firming refers to making a water right available by a means such as firming storage, exchange or other means.

Fluvial. Found in rivers or streams.

Fort Lupton. City of Fort Lupton.

Fort Morgan. City of Fort Morgan.

Ground water. Water found under ground in porous rock strata and soils.

Independent utility. A test to determine what constitutes a single and complete project in the Corps regulatory program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases are not built can be considered as separate single and complete projects with independent utility.

Indirect economic impact. The change in sales, income or employment within the local region in industries that supply goods and services to directly affected businesses.

Induced impact. The change in sales within the local impact region that result from changes in local household spending of income (on housing, utilities, groceries, etc.) earned in the tourism, construction and other supporting industries.

Input-output analysis. An analysis of the flows of economic activity between sectors, that captures what each sector must purchase from every other sector in order to produce a dollar's worth of goods or services.

Intermittent. A stream or drainage that flows periodically during the year. It may flow during certain seasons, or storm events, but does not flow year-round. Intermittent streams may or may not be supplied by ground water.

Junior water right. Water rights that were obtained more recently and therefore are junior in priority to older or more senior water rights.

Lacustrine wetland. Wetland associated with deep water such as lakes and ponds.

Lafayette. City of Lafayette.

LHWD. Lefthand Water District.

Loss. Loss of water that results from factors such as system loss, evaporation, and others.

LTWD. Little Thompson Water District.

M&I. Municipal and industrial water rights or water uses.

Maximum contaminant level. The legal threshold limit on the amount of a hazardous substance that is allowed in drinking water under the Safe Drinking Water Act. The limit is usually expressed as a

concentration in milligrams or micrograms per liter of water.

Mesic. Of, characterized by, or adapted to a moderately moist habitat.

Mitigation measure. A measure taken to offset the adverse impacts resulting from an action or activity.

MODSIM. A general purpose simulation model for evaluating the operations of river and reservoir systems including the historical operation and administration of major direct flow and water storage rights.

Moisture regime. Moisture regime refers to the amount of moisture typically in the soil in a given area. For example, areas with aquic moisture regimes (wetlands) are located in depressions or other areas where surface or ground water is abundant in the soil.

Mule deer winter concentration areas. That part of the winter range where densities are at least 200 percent greater than the surrounding winter range density.

Mule deer winter range. That part of the overall range where 90 percent of the individuals are located during the average five winters out of 10.

Native flows. Historical streamflow levels that are representative of flows prior to any water projects that remove or put water back in the river.

NCWCD. Northern Colorado Water Conservancy District.

New firm yield. A new firm water supply (see firm yield).

New reliable municipal water supply. A new source of water for municipal uses.

No injury rule. Under the doctrine of prior appropriation, junior appropriators may not impair the water rights of senior appropriators. Junior

appropriators are also protected from the actions of senior appropriators to the extent that juniors are entitled to the continued maintenance of stream conditions (e.g., timing and rates of flows, water quality, etc.) as they existed at the time of the junior appropriation. Should a senior appropriator seek to change the point of diversion, time, place, or purpose of use, steps such as the mitigation of return flows must be taken to ensure that the junior appropriator's ability to divert water is not diminished. This principle is known as the "No Injury Rule."

Nonfederal project. A project conducted by a municipality, state, or private entity that is not funded by the federal government.

Officially eligible (for listing in the National Register of Historic Places). Historic or archaeological resources that have an official determination of eligibility from the State Historic Preservation Office.

Overall range. The area that encompasses all known seasonal activity areas within the observed range of a species.

Palustrine emergent wetland. A wetland dominated by trees, shrubs, and herbaceous vegetation. May include wet meadows, swamps, bogs and fens.

Perennial stream. A stream that flows continuously throughout the year.

Phreatophyte. Any plant species that obtains a significant portion of the water that it needs to survive from the zone of saturation or the capillary fringe above the zone of saturation. These species are found in riparian ecosystems and other areas characterized by shallow groundwater, such as bottomlands.

Price signal. The message sent to consumers and producers in the form of a price charged for a

commodity; this is seen as indicating a signal for producers to increase supplies and/or consumers to reduce demand.

Prior appropriation. The water law doctrine that confers priority to use water from natural streams based upon when the water rights were acquired. Water rights in Colorado and other western states are confirmed by court decree; holders of senior rights have the first claim to withdraw water over holders who have filed later claims (also called junior water rights).

Priority of water right. The ranking of a water right vis-à-vis all other water rights drawing on the stream system.

Project area. The counties and drainage basins in which the Participants are located.

Project concept. For purposes of the NISP EIS, a source of potential water supplies able to meet a substantial portion of the NISP Participants' requests. Concepts include such things as construction of new reservoirs, new water rights, transfer of agricultural water rights, and use of existing reservoirs, or enlargement of existing reservoirs.

Project element. For purposes of the NISP EIS, a project element is a specific structure such as the Glade Reservoir, a specific water right, or a specific gravel pit.

Pronghorn severe winter range. Winter range where 90 percent of the individuals are located when the annual snow pack is at its maximum and/or temperatures are at a minimum in the two worst winters out of 10.

Pronghorn winter concentration area. Winter range where pronghorn densities are at least 200 percent greater than the surrounding winter range density.

Qualitative. A form of assessment that analyzes the impacts in a descriptive manner (e.g., low, moderate, or high).

Quantitative. A form of impact assessment that analyzes the impacts using numerical metrics (e.g., acres or cfs).

Quota. The portion of the C-BT that a shareholder (or allottee) is entitled to in a given year.

Recreational visit. A measurement used to count visitors. One recreational visit is equal to one person participating in any recreational activity during a visit to a recreational area. This includes activities such as sightseeing, touring, and driving, and is not directly related to any specific time period.

Retaining wall. A wall constructed along a roadway. It is often used in steep terrain and eliminates the need for all or a portion of a fill or cut slope.

Return flow. Water that returns to streams and rivers after it has been applied to beneficial use. Return flows may return as surface flow, or as an inflow of tributary ground water.

Reusable return flow. Return flows that the owner of a water right has the right to reuse.

Reverse osmosis. The process where a solvent (water) is passed through a semi-permeable membrane which retains solutes (impurities) on one side and allows the pure solvent to pass through using the application of pressure. This process is used to purify water.

Riparian. Areas along creeks or streams and between the aquatic and terrestrial environment.

Road prism. The road pavement plus additional cut and fill slopes required to construct the road.

Rock scaling. The removal of rock from steep cliff faces, typically where falling rocks are expected to occur in the near future.

Safety factor. A percentage factor added to account for uncertainties in water demand forecasts or river impacts projections. In the NISP EIS, the safety factor is used in two contexts: (1) a 10% safety factor was added to Participant demands in order to account for the inherent inaccuracies in forecasts of future demands, and (2) a 5% safety factor was added to the simulated project demand in the Poudre Basin MODSIM network in order to account for unknowns such as Reclamation exchange shrink charges, dam seepage, and other factors that may diminish water yields prior to delivery to the Participants. This also has the effect of conservatively estimating flow impacts to the Poudre River.

Secondary economic impact. The change in economic activity that results from subsequent rounds of re-spending tourism dollars or direct road construction expenditures. Secondary impacts may be further divided into indirect or induced impacts.

Section 404 permit. An authorization granted by the Corps under Section 404 of the Clean Water Act to place dredge or fill material in a water of the U.S.

Sedimentation. The transport of sediment into a water body.

Senior water right. Under the prior appropriation doctrine, water rights are allocated on a "first in time, first in right" basis. That is, the first person in time to put water to a beneficial use is granted the earliest priority water right. The early appropriations are referred to as "Senior Water Rights." A senior water right has an early appropriation date (usually in the late-1800s), a lower administration number, and priority relative to other water rights. The lower the priority, the more

senior the water right. In the Cache la Poudre Basin, senior water rights are those with water district priorities lower than 97 (which corresponds to the North Poudre Canal 614 cfs right, with an appropriation date of February 1, 1880, and administration number 18989, according to SPDSS memos documenting District 3 and NPIC).

Simple average. The arithmetic mean, or average, of a set of quantities.

Slump. A shifting in the ground, often caused by water intrusion on a steep slope.

Species of concern. Federally listed threatened and endangered species; species listed by the CDOW as Colorado state threatened, endangered and other species of concern; and species ranked as rare, vulnerable, or imperiled in the state by the Colorado Natural Heritage Program (CNHP).

Specific conductance. Measure of the ability of a water to conduct an electrical current, expressed in micromhos per centimeter at 250C.

Spells analysis. This analysis combines elements of the flow duration analysis and flood frequency analysis. It is different than a flow duration analysis in that the spells analysis considers individual flow events rather than combining them. The spells analysis is different from a flood frequency analysis in that the spells analysis considers the duration of individual flood events, not just their occurrence. The spells analysis was used in the assessment of effects to stream morphology and riparian vegetation.

Storage right. A storage right is a type of water right that is measured in terms of volume. Storage rights allow a water user to store water for later beneficial use.

Storage-to-yield ratio. The storage to yield ratio is the relationship between the amount of storage

necessary to provide for a given amount of firm yield.

Structural diversity. The diversity of heights and growth forms of vegetation in a stand. Also includes standing and fallen dead vegetation.

Subdistrict. The Municipal Subdistrict of the Northern Water Conservancy District. The Subdistrict is the entity responsible for the Windy Gap FIRMing Project.

Surface water. Water that flows on the surface, either in streams or as surface runoff across the ground.

SWSI (Statewide Water Supply Initiative). A study commissioned by the Colorado Water Conservation Board to quantify current and future water demand and supply to evaluate options for water management including conservation. This effort focused on Yampa/White/Green, Colorado, Gunnison, Dolores/San Juan, Rio Grande, Arkansas, South Platte, and North Platte river basins.

Take (as defined by Colorado Statute 33). To acquire possession of wildlife; but such term shall not include the accidental wounding or killing of wildlife by a motor vehicle, vessel, or train. "Possession" means either actual or constructive possession of or any control over the object referred to.

Take (as defined by the ESA). To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct; may include significant habitat modification or degradation if it kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering.

TCE. Trichloroethene.

Total dissolved solids (TDS). Combined content of all inorganic and organic substances contained in a

liquid which are present in a molecular, ionized or micro-granular form. Primary sources of TDS are agricultural run-off, leaching of soil contamination, and point-source water pollution discharge from industrial or sewage treatment plants.

Total water delivery. The amount of water that must be delivered to meet a Participant's water need.

Total water requirement. The total water required to meet a Participant's (or municipality or user) water need, including potable and non-potable water. The total water requirement may be larger than the total water demand because it includes estimates of some of the system losses and other variables.

Transfer. The sale and/or purchase of a water right.

Tri-Districts. A collective of three water districts including the FCLWD, the East Larimer County Water District (ELCO), and the North Weld County Water District (NWCWD).

Unappropriated water. Water that has not been placed in beneficial use by being diverted, stored, or captured.

Ungulate. Hoofed mammal such as elk, deer, bighorn sheep, mountain goat, and moose.

Upland. Hills, plains, mesas, or other areas not in riparian or wetland areas, and where the vegetation is not supplied by hydrology from a stream or drainage.

Visitor spending profile. A breakdown of average, daily visitor (or party) expenditures within relevant tourism sectors (e.g., lodging, restaurants, groceries, souvenirs, etc.).

Water delivery. The amount of water delivered to a water user.

Water demand. The amount of water that municipalities or regions require for everyday functioning.

Water requirement. The amount of water required to achieve a specific delivery goal. Water requirements include system losses and evaporation, and generally are larger than the delivery goal. Water requirements are based on, but may not be equal to use, demand, and delivery goals.

Water right. A right to use, in accordance with its priority, a portion of the waters of the state by reason of the appropriation of the same.

Water use benchmarks. Metrics of water use benchmarks are used to compare a community or water user's water use to another representative community or standard.

Water use entitlement. A legal or contractual provision, such as a water right, granting the use of a specified volume or flow rate of water.

Waters of the U.S. As defined in the Clean Water Act, all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide. All interstate waters including interstate wetlands. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce.

Wetland. Area near the margin between water and land (such as swamps and marshes) that is wet enough to support plant growth typically found in saturated soil conditions.

WGFP. Windy Gap Firing Project. A project proposed by the Subdistrict to firm the yield from the Windy Gap project.

White-tailed deer concentration area. Corridors of riparian habitat that support higher populations of

white-tailed deer, serve as travel corridors and are considered critical habitat for white-tailed deer.

Windy Gap Project. A project operated by the District that collects and stores water on the western slope and delivers it to the Windy Gap project participants.

Yield. The amount of water that a water right supplies under a defined scenario.

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